



**Audit of
trauma
management
in Scotland.**

**Annual
Report
2017.**

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PHI Graphics Team
NHS National Services Scotland
Gyle Square
1 South Gyle Crescent
Edinburgh EH12 9EB

Tel: +44 (0)131 275 6233

Email: nss.phigraphics@nhs.net

Designed and typeset by:

Chris Dunn, PHI Graphics Team

Translation Service

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Foreword



To be asked to write the introduction to the 2017 STAG annual report allows me the opportunity to acknowledge and laud publically the central and crucial role played by the national asset and internationally regarded coordinated system that is the Scottish Trauma Audit Group (STAG). That STAG and the Scottish Trauma Network (STN) are working closely together will, I have no doubt, prove to be of great benefit to our patients, their families, and the nation.

This year's report continues to demonstrate STAG's evolution, expertise and continuing development on a number of fronts.

I look forward to seeing the validated benefits of real-time improvement engines such as eSTAG reporting throughout the many hospitals within the Network, via a shift from Quality Indicators (QIs) to Key Performance Indicators (KPIs), and to improved outcomes.

The goal of course, is a continual improvement in quality and safe care for the traumatised patient, whether that is at home, at work, by the roadside, or somewhere more distant and challenging. For our patients on this journey, successful rehabilitation thereafter will of course be dependent on all the interventions and improvements in quality care that came before.

As the National Clinical Lead for the new STN, and as an Emergency Physician practising in Emergency Departments (ED) in what will be known as a Local Emergency Hospital (LEH), a Trauma Unit (TU), and a Major Trauma centre (MTC), STAG's place has always been central. It is even more so now as we press on as we seek to deliver the Network for the nation. It is clear to me that the expertise and detail provided by the breadth and depth of STAG's data collection, and its informed interpretation, will continue to provide the detailed evidence-base to support and allow the Network to develop, refine and flourish from the very outset.

I commend the supporting pieces in this Report by my colleagues Malcolm Gordon, Chair of STAG, and Kate Burley, Associate Director of the Scottish Trauma Network. They describe on behalf of the many healthcare providers and professionals within our organisations, the process and progress ongoing. It is a privilege to endorse, support and thank them all for their valued efforts and contributions.

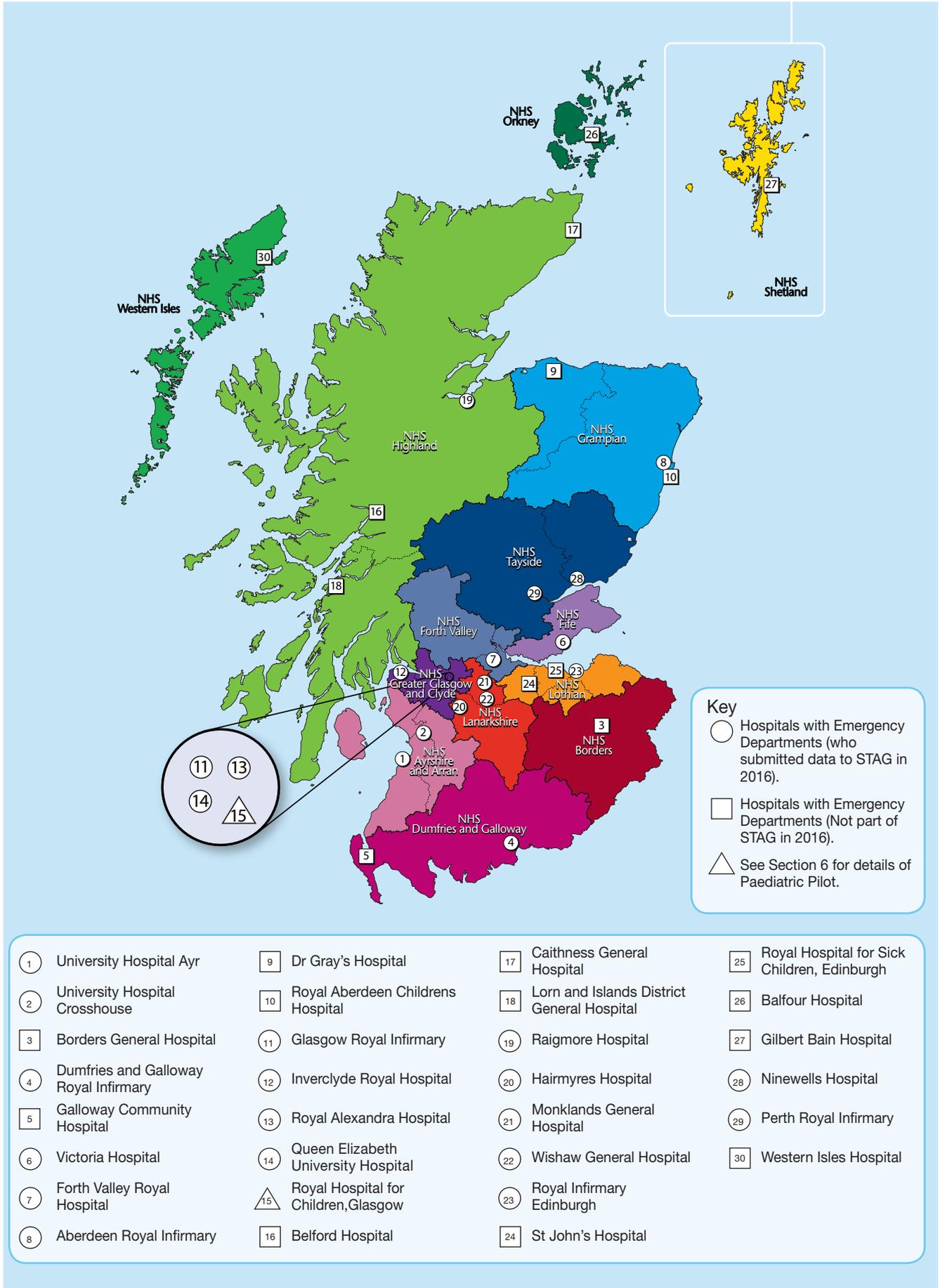
Our work is to save life, and to give life back.

Dr Martin McKechnie

National Clinical Lead

Scottish Trauma Network

Location Map



Introduction

The care of the injured patient touches all parts of the hospital. Traditionally seen as a “surgical” problem of younger people, our aging population is changing this situation. The proportion of older patients is creeping up which brings more complex medical needs as the likelihood of important pre-existing illnesses increases with age. These co-morbidities may well have played a role in the incident that resulted in the injuries and would have complicated the management. This will have included the assistance of “medical” specialities.

The 2017 STAG annual report focuses on the calendar year 2016 and presents detailed information of the patient journeys of 3442 patients with severe injury (trauma) that have passed through the Scottish healthcare system. Within the report we describe trauma in three groups: minor, moderate and major, however it is important to remember that the “minor” group of patients have been injured severely enough to spend a minimum of three days in hospital or have died as a consequence of their injuries. Although there are many more admissions to our hospitals as a consequence of an injury, this audit focuses on the most severely injured end of the spectrum.

In response to the continuing significant public health burden of serious injury, the National Health Service (NHS) in Scotland is planning to centralise the care of the most seriously injured patients in four MTCs; supported by a network of designated TUs and LEHs. These changes will be implemented in stages and will bring a shift from the existing standards, QIs to new KPIs which STAG will continue to monitor and report on. This will allow the NHS Scotland and the general public to see the improvements that the combination of this service change and investment will bring.

This year’s report contributes to a robust baseline upon which these changes can be assessed. The proportion of ED patients included in the audit is over 80%¹ and this will increase in the next year with planning to include patients who attend all 30 hospitals with designated EDs underway. There will also be an increase in patients included due to the expansion of the audit to include all children aged less than 13 years later this year.

We would like to acknowledge the work of the thousands of healthcare providers who have provided high quality care aligned with these patient journeys. The role of the STAG audit, and of the dedicated audit professionals in each contributing hospital, is to collect, verify and feedback outcome information to local teams, and to assure patients, families and clinicians that the care we provide is the best possible. Identifying areas where trauma care could be further improved and then achieving this improvement is paramount.

Mr Malcolm WG Gordon

Clinical Director for Emergency Medicine
Queen Elizabeth University Hospital,

Chairman
Scottish Trauma Audit Group

The Scottish Trauma Network



The Scottish Trauma Network (STN) has been established to support each of the four regional networks (North, East, South East and West), the Scottish Ambulance Service (SAS) and the STAG to work together to establish a trauma network across Scotland, and support the networks aim of “Saving lives and giving life back”.

The STN team is now in place with an Associate Director, Programme Manager, Programme Support Officer and Lead Clinician and has been working with regions, SAS and STAG to support the implementation of regional networks and their planning across Scotland.

The STN Steering Group agreed to provide funding for the STAG to implement questionnaires recording Patient Recorded Outcome Measures (PROMS)² to the same standards as those used in NHS England. STAG are ensuring that correct permissions are in place from the Privacy and Public Benefit Panel³. Questionnaires and data collection methodology is agreed and requirements for Research/Ethics permission are being confirmed. The PROMs programme is due to start in March 2018.

STAG has also been progressing work on implementing their electronic database (eSTAG) November 2017.

Working with clinical and management leads from each of the regional networks, SAS and STAG (who form the STN Core Group), the network has now agreed the minimum requirements necessary to be able to allow a regional network to open their MTC. These will now serve to support planning and prioritisation within the regions.

Initial meetings for all of the five work streams with the addition of paediatrics are now starting to happen and will be fully formed over the next few months. This will allow work to progress with defining services for paediatrics, rehabilitation and other facets of the network including prevention, education, training, workforce and major incident planning.

A launch event for the network including STAG is planned for the 18th and 19th January 2018 at Murrayfield Stadium, Edinburgh.

If you are interested in hearing more from the STN, or have any questions, please email nss.scotrauma@nhs.net or visit <http://traumacare.scot/>

Kate Burley

Associate Director

Scottish Trauma Network

National Services Division

Summary and Main Points

STAG now hold a trauma database that has information on over 20,000 patients treated in 2011-2016. Data collection is centred on hospitals that routinely treat patients with significant trauma and we aim to include all hospitals with an ED in the next year.

18 out of 30 hospitals with an ED submitted data to STAG in 2016 (including the Royal Hospital for Children (RHC), Glasgow). These 18 hospitals receive over 80% of all emergency admissions in Scotland.

A further three hospitals began submitting data in 2017 (St John's Hospital, Livingston, Dr Gray's Hospital, Elgin and the Royal Aberdeen Children's Hospital) and STAG are supporting resource planning with the remaining hospitals to ensure data collection will start in 2017/18.

The launch of a bespoke electronic data collection system (eSTAG) in November 2017, will allow STAG to monitor the full patient journey, which may start in hospitals or health centres without EDs in some cases, especially in more rural parts of Scotland.

Main Points

Patients, demography and trauma type

- STAG reports on 3442 patients with significant trauma in 2016. Section 6 gives an overview of patients who attended the RHC, Glasgow.

779 patients were classified as sustaining major trauma in 2016 (23%).

- Males make up the majority of trauma patients (58%), rising to 72% for major trauma.
- There has been a significant increase in the median age from 2011-2016 (53 to 57 years), mirroring the ageing population.
- Females were most commonly injured by low falls, whereas injuries to males were due to falls and moving vehicle accidents.
- There is evidence to suggest that alcohol remains a factor in many trauma incidents (either the alcohol was ingested by the patient or another contributor to the trauma), and this is most predominant in males suffering major trauma (26%) in 2015.
- 24% of patients aged ≤ 16 years who presented at the RHC, Glasgow, sustained major trauma in June 2015 to May 2016, rising to 31% in June 2016 to May 2017.

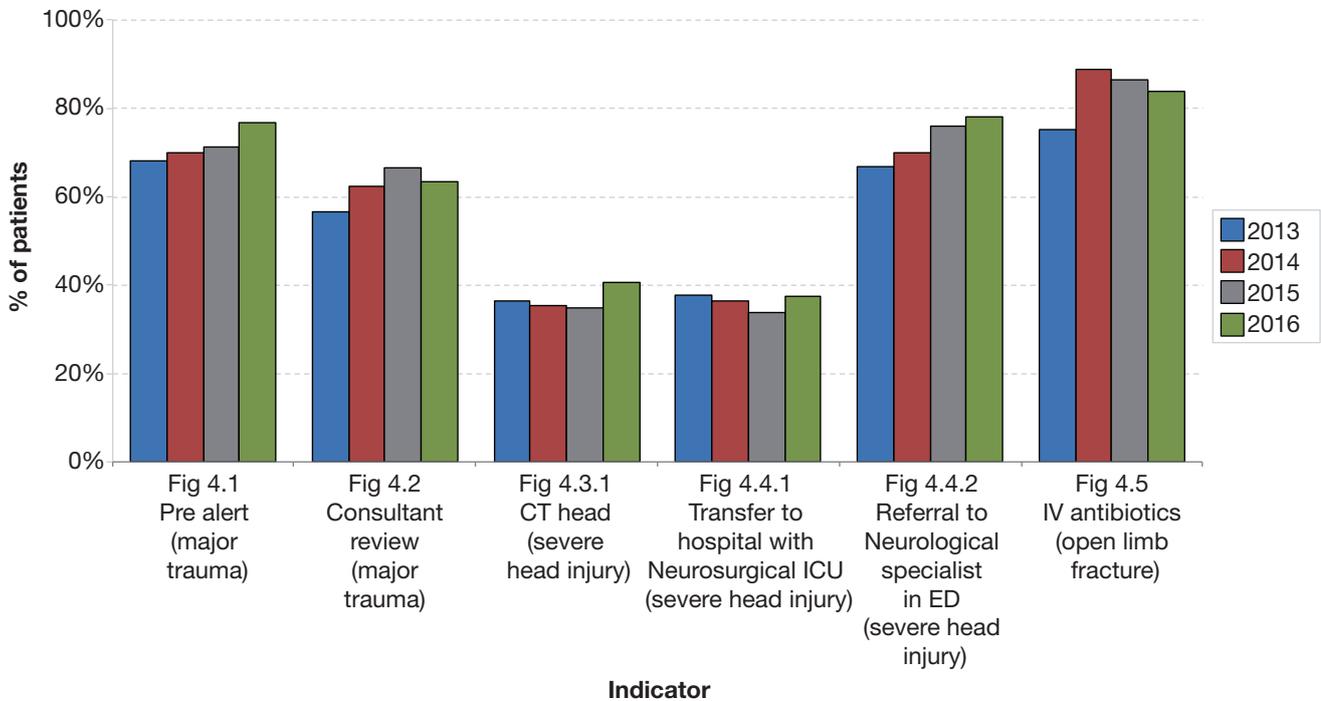
The patient journey

- In 2016, 79% of patients with minor trauma arrived by road, via the Scottish Ambulance Service (SAS) rising to 84% for patients with major trauma. 10% of major trauma patients arrived by air ambulance.
- 54% of trauma patients (aged ≥ 13 years) arrived in the ED in the out of hour's period (between 8pm and 8am or at the weekends), with 16% of patients presenting between midnight and 8am.
- Data from the RHC, Glasgow (2015-2016) showed that 99% of paediatric patients (aged ≤ 16 years) attended between 8am to midnight.

25% of major trauma patients were transferred to another hospital and 65% of these patients were transferred in the first 24 hours.

- The majority of transfers are for Regional Neurosurgery Care (40%) and to the National Spinal Injuries Unit (21%).
- 53% of major trauma patients who survive to hospital discharge have a length of stay (LOS) >14 days.
- Of the patients who die following trauma, LOS is shorter for the more severely injured patients.

Quality Indicators 2016



Compliance with QIs is fairly static nationally, but shows wide variation between hospitals. STAG will introduce new KPIs later this year in preparation for the introduction of the STN next year.

Patient outcome

- The crude mortality rate for all patients was 6%. This rises to 23% for patients with major trauma.
- In 2014-2016, the mortality rate for all of the hospitals contributing to STAG was within 3 standard deviations using the Revised W-Statistic, meaning that no hospital had significantly different mortality rates.

Section 1: Data completeness

Figure 1.1 Data completeness by hospital (2016)

Key: Data submitted
 No data submitted

Hospital	2016												Patients Included
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
University Hospital Ayr	9	7	11	6	3	14	10	9	6	9	7	8	99
University Hospital Crosshouse, Kilmarnock	17	8	16	11	17	13	14	9	13	18	9	12	157
Dumfries & Galloway Royal Infirmary	6	12	13	2	10	13	10	6	17	12	6	5	112
Victoria Hospital, Kirkcaldy	17	12	7	16	22	19	16	17	11	9	13	8	167
Forth Valley Royal Hospital	30	18	13	14	18	15	15	13	13	16	15	16	196
Aberdeen Royal Infirmary	35	23	24	29	34	28	24	27	39	32	26	18	339
Glasgow Royal Infirmary	30	27	38	26	30	35	27	38	32	41	31	36	391
Inverclyde Royal Hospital	8	6	9	9	5	9	9	15	8	8	11	10	107
Queen Elizabeth University Hospital, Glasgow	43	36	46	36	43	49	52	45	33	36	44	42	505
Royal Alexandra Hospital, Paisley	24	16	18	22	28	20	15	22	21	22	18	30	256
Raigmore Hospital, Inverness	15	13	17	21	8	19	13	25	10	13	10	16	180
Hairmyres Hospital, East Kilbride	12	9	17	11	18	13	14	12	10	21	16	12	165
Monklands Hospital, Airdrie	5	8	12	15	7	6	13	9	10	6	8	8	107
Wishaw General Hospital	10	5	9	12	11	14	6	11	9	6	13	10	116
Royal Infirmary, Edinburgh*	30	30	25	46	48	23							202
Ninewells Hospital, Dundee	23	15	21	22	29	23	28	22	32	34	30	18	297
Perth Royal Infirmary	5	8	7	3	9	4	6	5	6	3	4	2	62
Patients Included	319	253	303	301	340	317	272	285	270	286	261	251	3458

* Due to resource issues not all eligible patients have had a proforma submitted.

Note: In 2016, 16 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= 3,442).

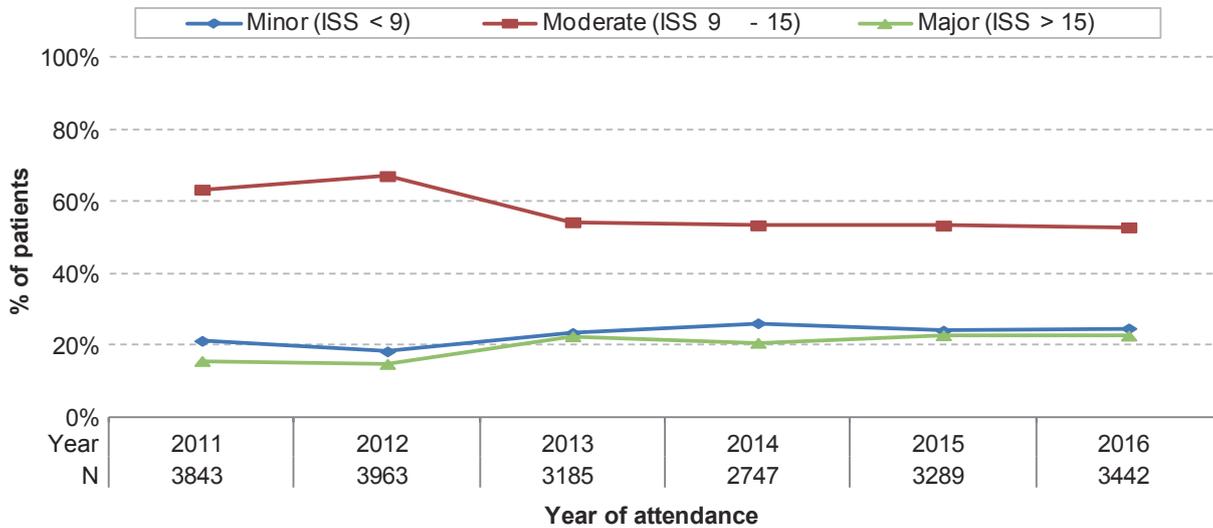
In 2016, 18 hospitals submitted data to STAG. Data on 17 of these hospitals are included in the main report and a summary of paediatric data collection at the RHC in Glasgow can be found in Section 6. A total of 3442 patients are included in the analysis.

Local staffing issues in one hospital meant that information was not available for the full year. The STAG team continue to work with all Health Boards to ensure Local Audit Coordinator (LAC) vacancies are filled and support is provided to ensure ongoing data submission.

STAG data collection is recognised as a priority for all Health Boards as changes are made to enhance trauma care in Scotland with the introduction of the STN.

Section 2: Demographics and type and severity of trauma

Figure 2.1 Percentage of patients by severity of trauma (2011-2016)

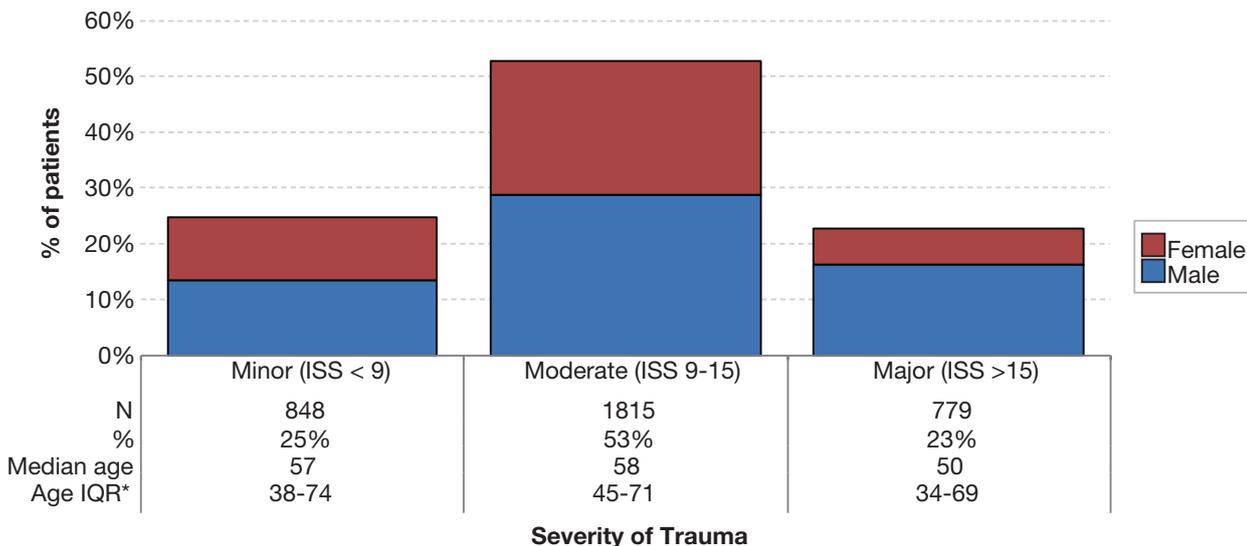


N: Number of patients per year.

Figure 2.1 shows the proportion of patients included in STAG from 2011-2016 and the severity of trauma based on the Injury Severity Score⁴ (ISS).

The year on year comparisons of the proportion of patients suffering minor, moderate and major trauma are broadly comparable since 2013.

Figure 2.2 Percentage of male and female patients by severity of trauma (2016)

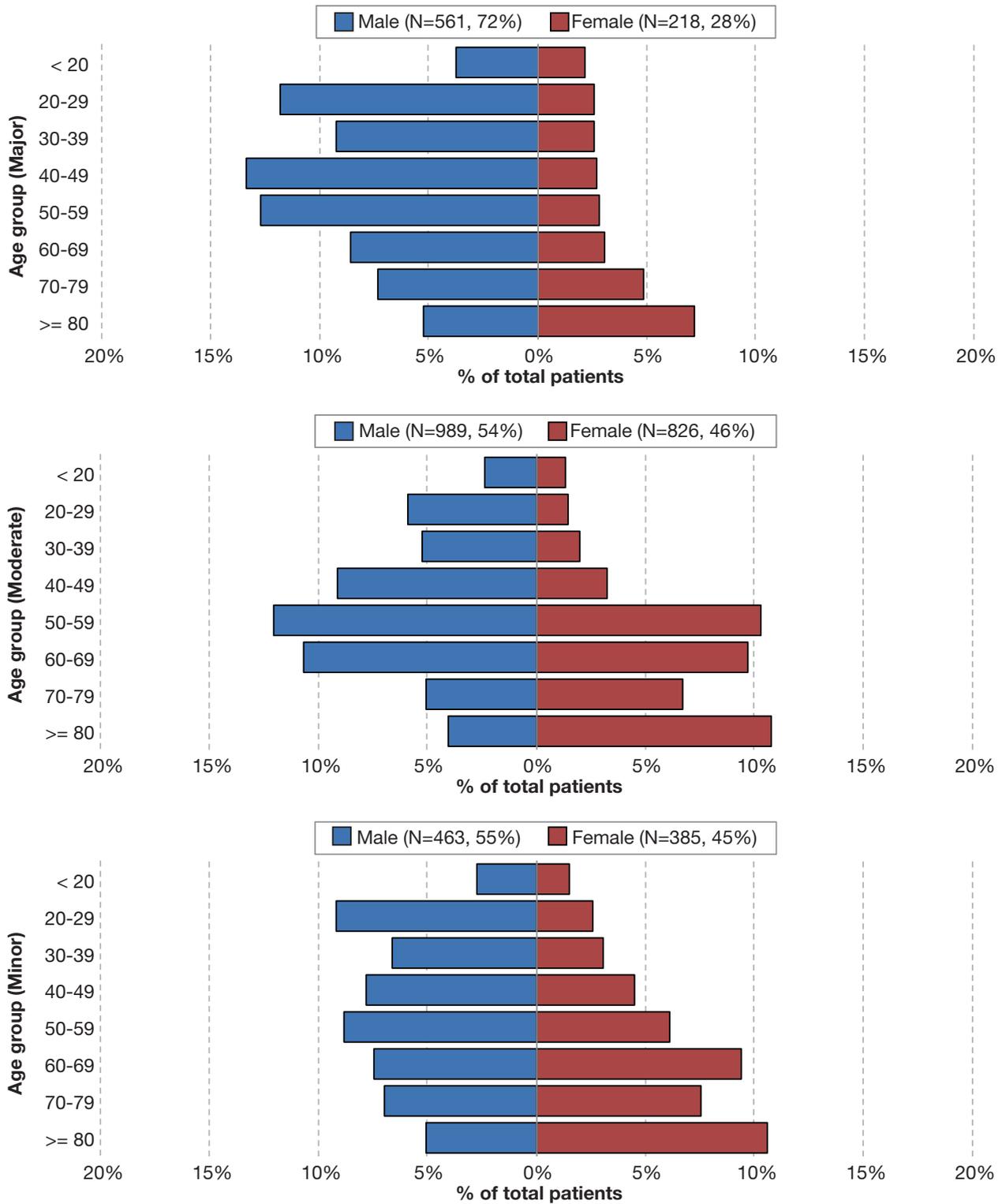


N: Number of patients.

IQR: Inter-quartile range.

The excess of male patients suffering major trauma is a pattern that is previously established and remains relevant for injury prevention strategies.

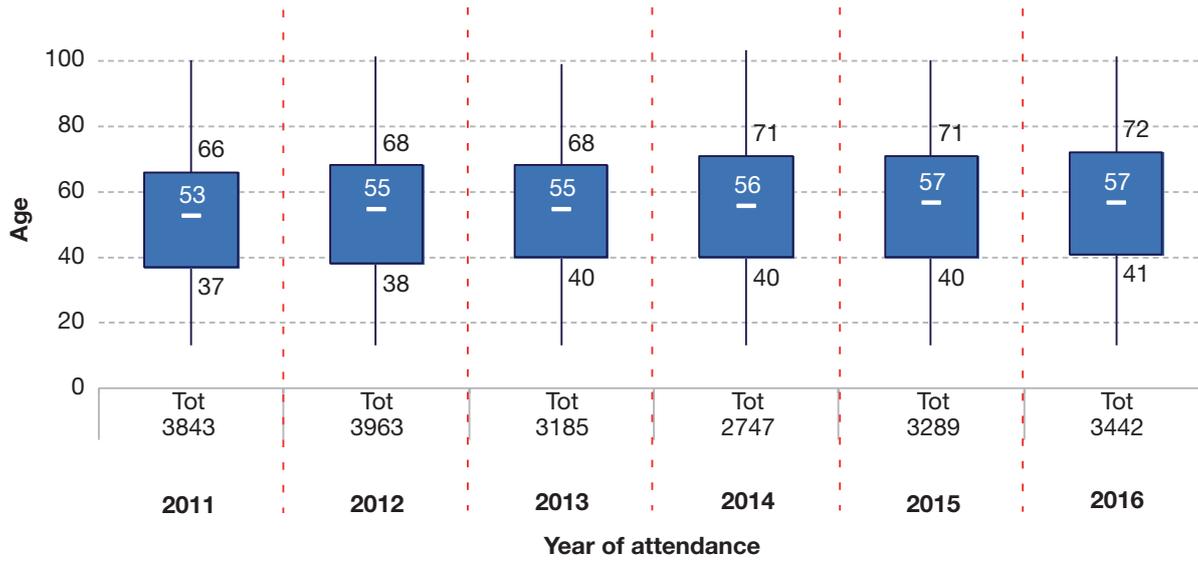
Figure 2.3 Age and gender distribution, by severity of trauma (2016)



N: Number of patients.

Figure 2.3 shows different injury patterns for men and women, in relation to age.

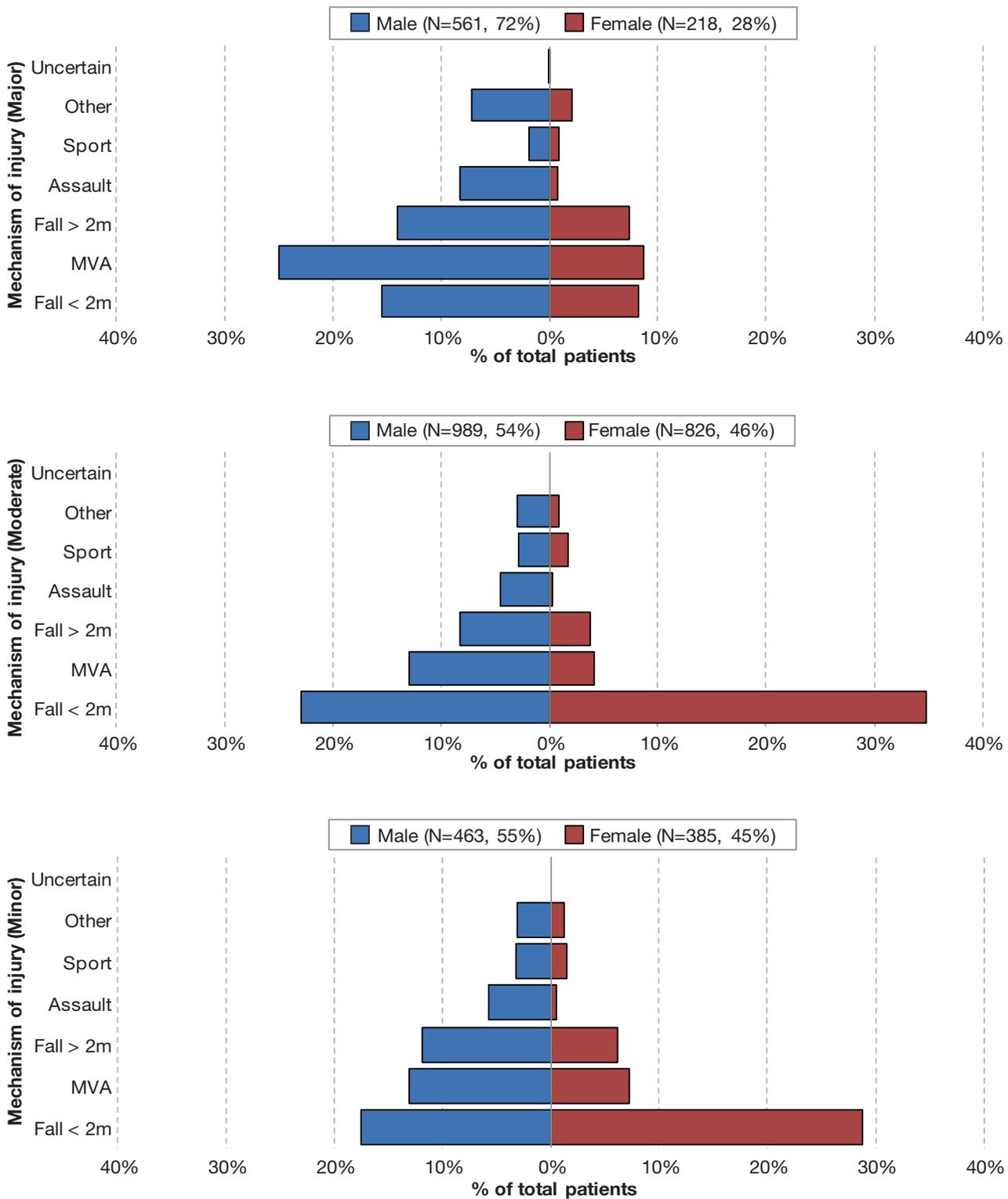
Figure 2.4 Median age (2011-2016)



N: Number of patients per year.

Figure 2.4 shows a significant rise in the median age from 2011 to 2016.

Figure 2.5 Percentage of male and female patients by mechanism and severity of injury (2016)



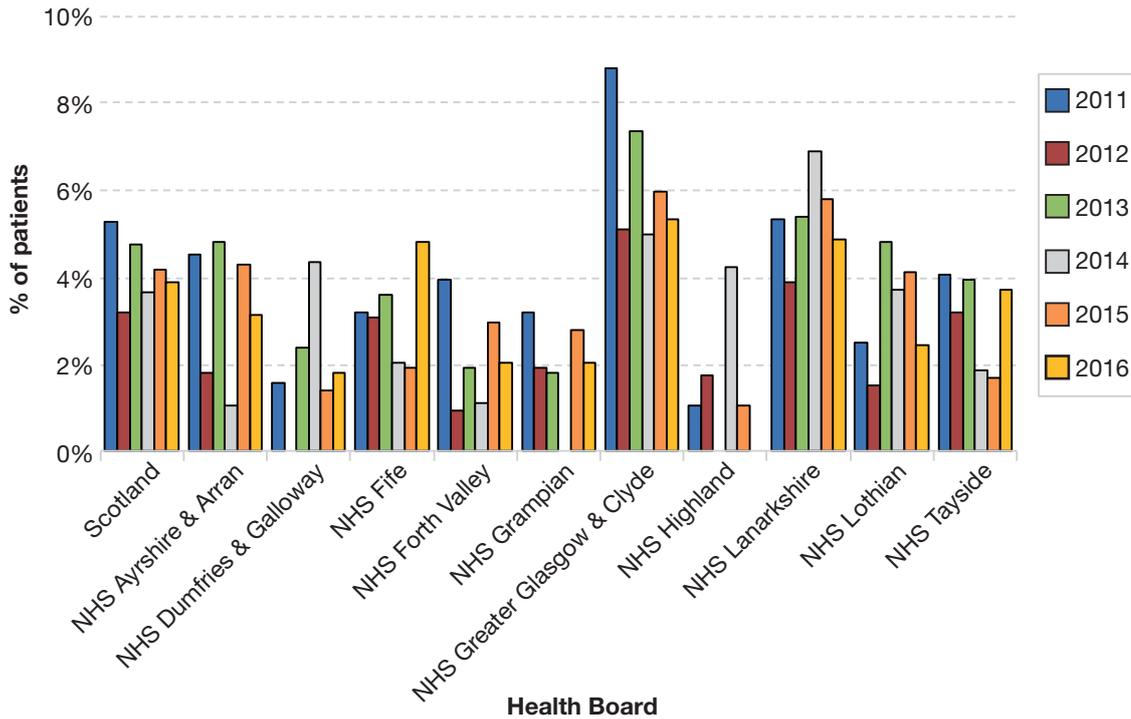
MVA: Moving vehicle accident (refers to motor vehicles eg train, car and includes bicycles but not motocross which is coded under sport).

Other: Mechanisms of injury such as contact with a moving object (not MVA) and accidents involving machinery.

Figure 2.5 shows that the predominance of females with minor and moderate trauma following a low fall and males with major trauma following MVAs and falls continues.

Mechanism of injury codes have been expanded in eSTAG to limit the number of injuries coded as 'other'.

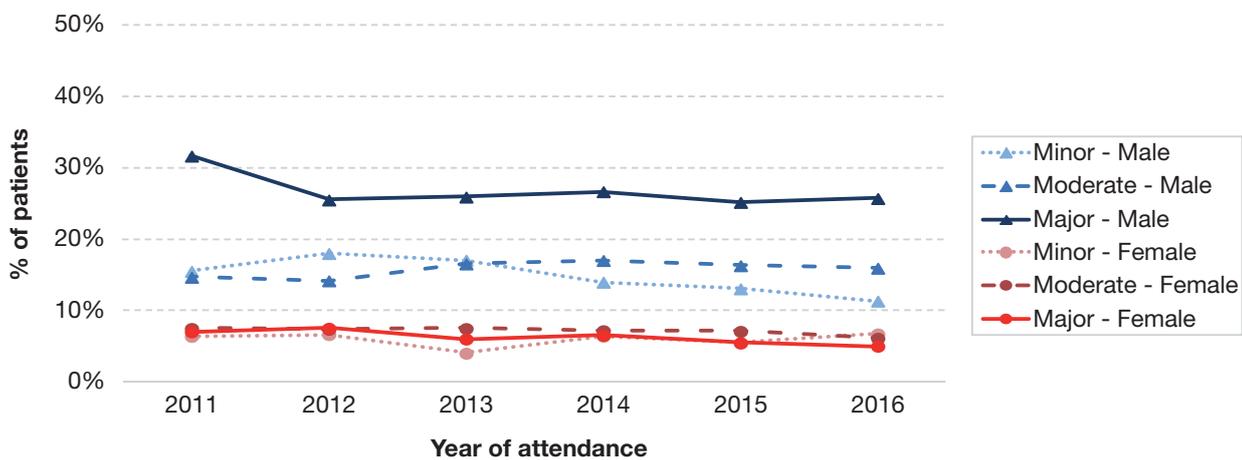
Figure 2.6 Percentage of penetrating trauma by Health Board (2011-2016)



Note: Please note that not all Health Boards contribute to STAG at this time.

Figure 2.6 shows year on year variation of the percentage of patients who have suffered penetrating trauma. In 2016, this ranges from 0% to 5% at Health Board level.

Figure 2.7 Percentage of male and female patients where there was evidence of involvement of alcohol, by severity of trauma (2011-2016)



Note: Data are 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.

Figure 2.7 shows that the association of alcohol involvement with all severities of trauma is consistent over the last six years. The association with males suffering major trauma continues.

Section 3: The Patient Journey

Figure 3.1 Percentage of patients arriving by air, ambulance or self, by severity of trauma (2011-2016)

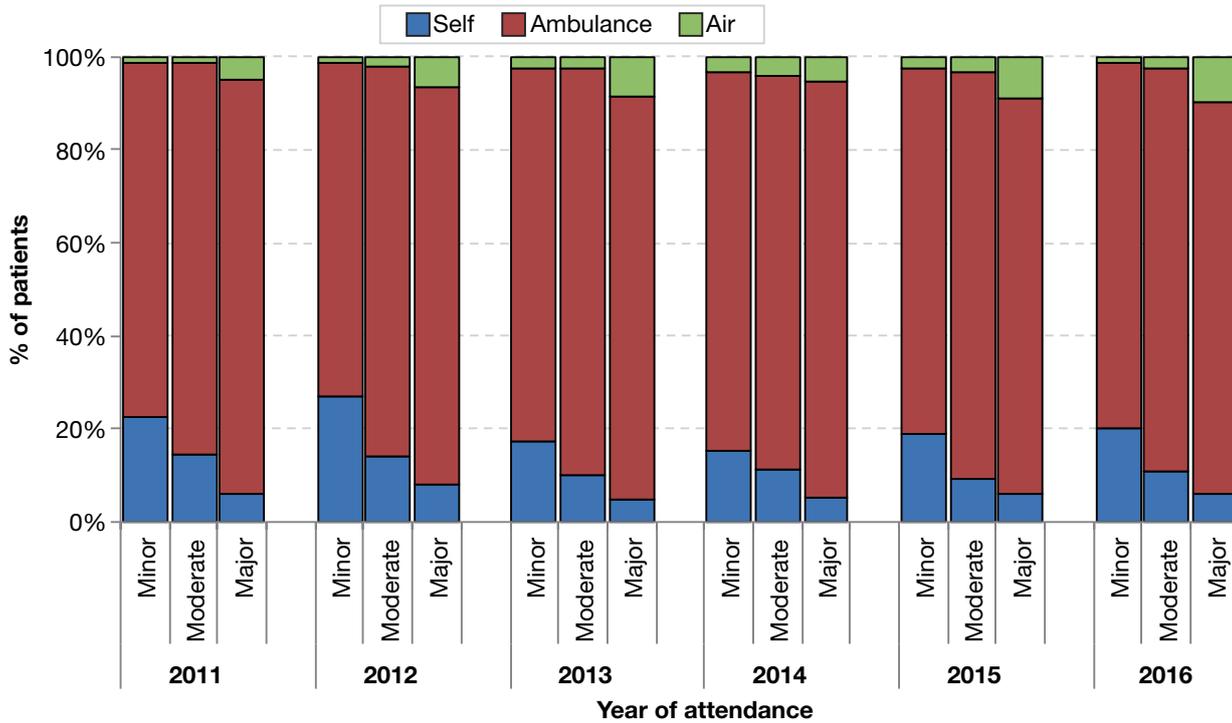
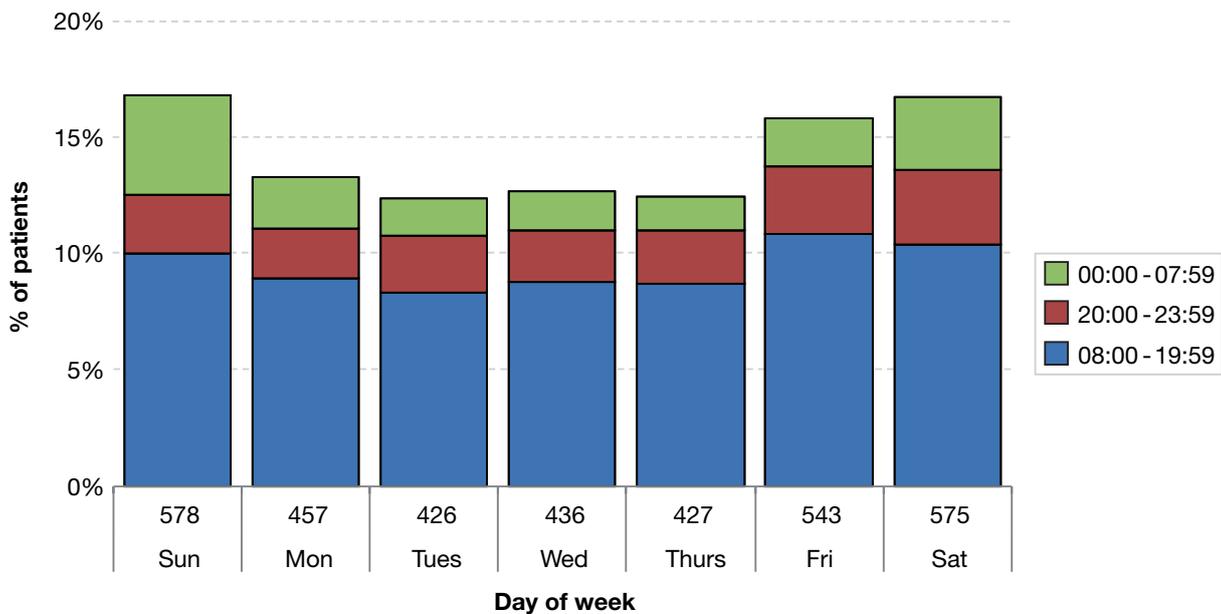


Figure 3.1 shows that the proportion of patients experiencing varying levels of trauma and their conveyance to hospital has remained relatively constant over the last six years.

Figure 3.2 Percentage of patients by day and time of attendance (2016)



N: Number.

Note: 'Out of hours' attendances are those that took place at the weekend or between the hours of 20.00 and 07:59 hours.

Figure 3.2 shows the number of trauma patients attending ED is stable from Monday to Thursday and then increases from Friday to Sunday.

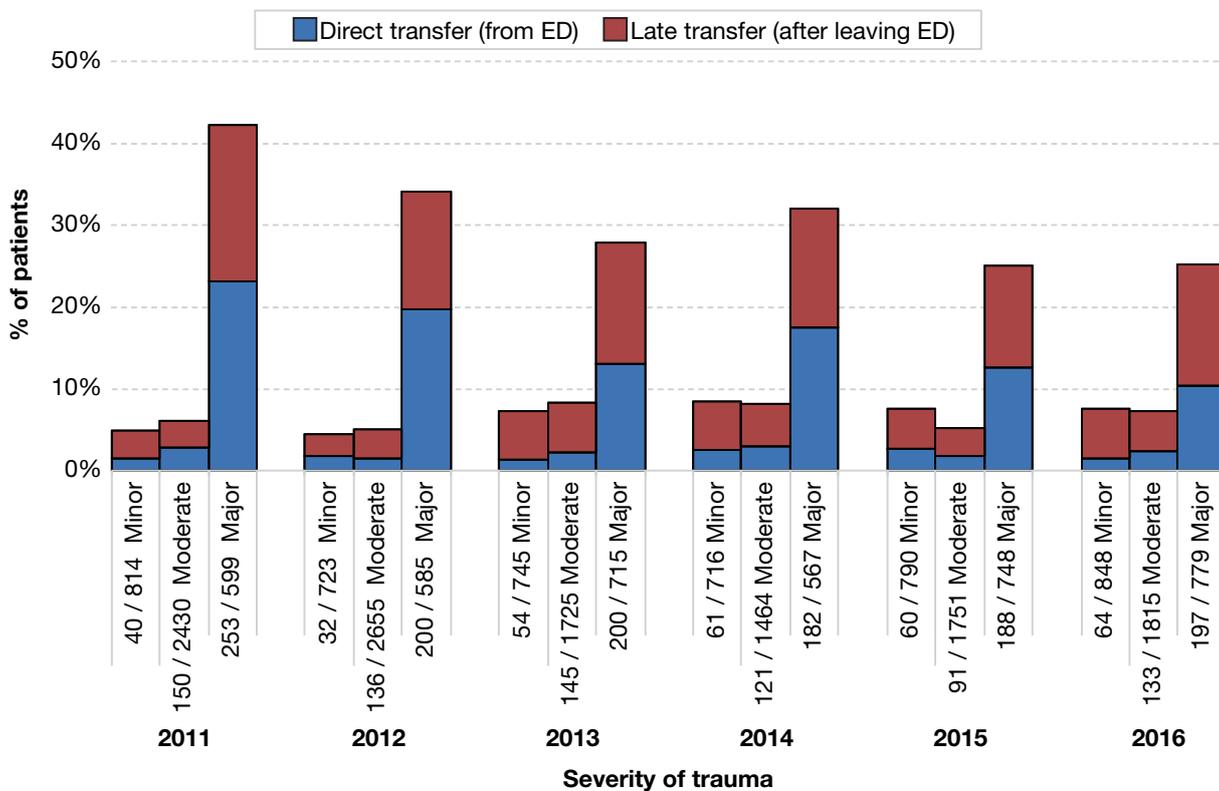
54% of attendances are considered 'out of hours' which is comparable with previous years.

The weekend shows an increase of attendances at night time (00.00-07.59hrs).

Data from the RHC, Glasgow (2015-2016) shows that 99% of paediatric patients (aged ≤ 16 years) attended between 08.00 and 00.00 hours.

The pattern of trauma presentations for both adult and paediatric patients should continue to be considered to inform workforce planning and rota management for EDs and the relevant in-patient specialities.

Figure 3.3 Percentage of patients transferred to another STAG hospital or regional centre, by severity of trauma (2011-2016)



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

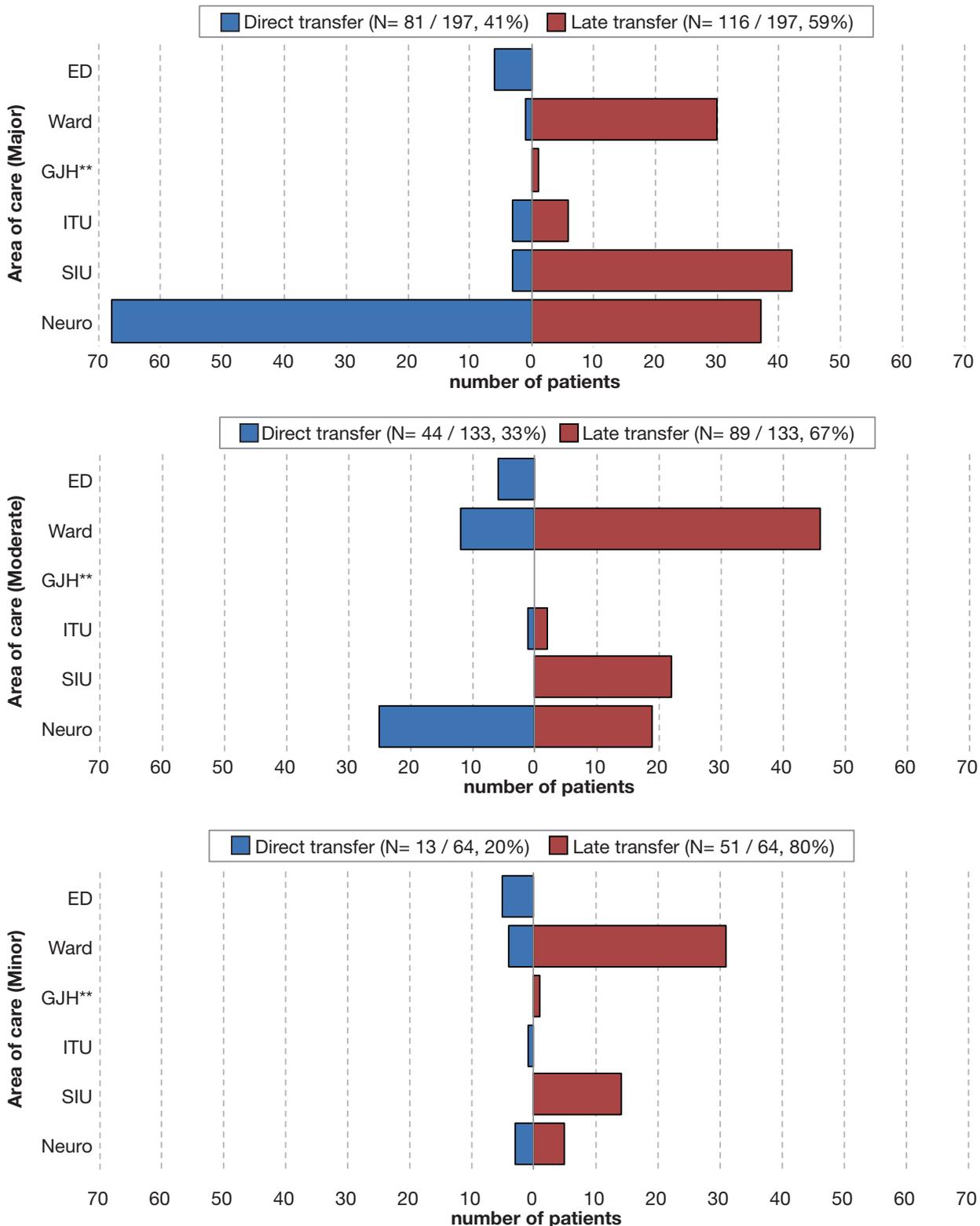
Note: 'Direct transfers' are those that occur directly from the receiving ED. 'Late transfers' are those that occur after the patient left the receiving ED.

Figure 3.3 shows that 25% of patients with major trauma were transferred to another hospital from the ED or hospital of initial attendance in 2016. The reduction of transfers in 2015 may be explained by the closure of two EDs in Glasgow.

In addition, 8% of minor and 7% of moderate trauma patients were transferred, which suggests that the initial receiving hospital could not meet all of the healthcare needs of these patients.

The transfer of patients between hospitals after trauma consumes additional healthcare resources. The STN is seeking to minimise these subsequent transfers by getting the patient to the place of definitive care directly from the incident location.

Figure 3.4.1 Area of care that patients were transferred to in the receiving hospitals, by severity of trauma and type of transfer (2016)

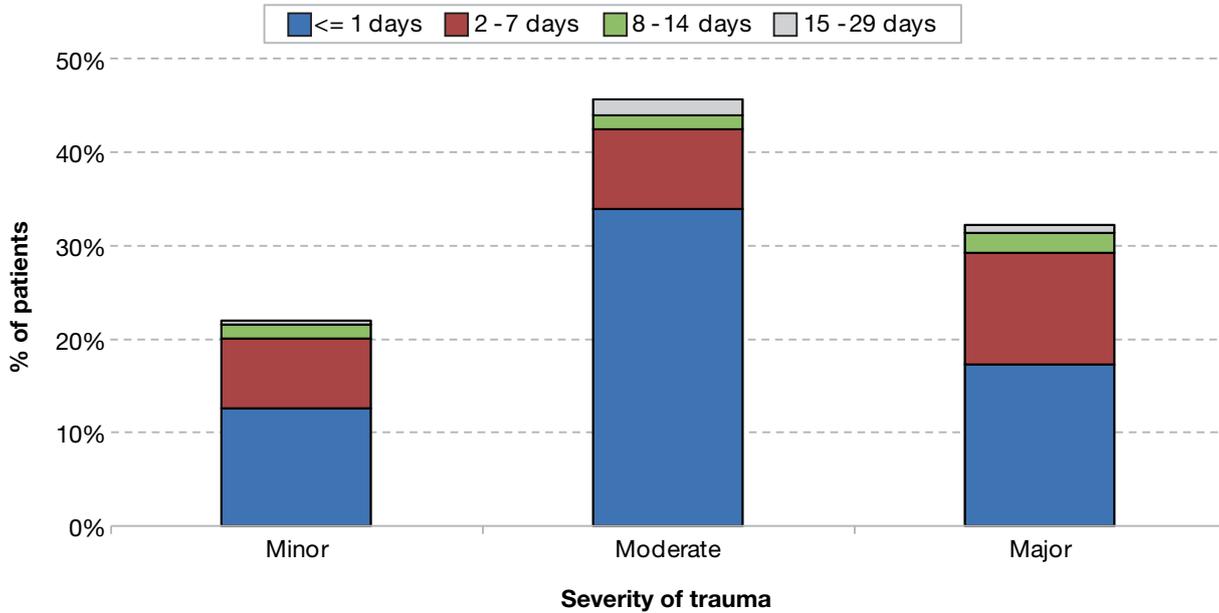


Note: 'Direct transfers' are those that occur directly from the receiving ED. 'Late transfers' are those that occur after the patient left the receiving ED.

** Patients were transferred to the Golden Jubilee National Hospital (GJH) for cardiothoracic care. STAG do not currently collect data on transfers to other Regional Cardiothoracic facilities, but this information will become available after the introduction of eSTAG.

Figure 3.4.1 shows that the vast majority of patients who are transferred from the initial receiving hospital are transferred either to neurosurgery or spinal injuries. This pattern has remained consistent. Transfers to neurosurgery are more commonly direct transfers from ED whereas transfers to the Spinal Injuries Unit (SIU), in Glasgow happen later in the patient journey. This is due to normal clinical practice as the SIU would rarely admit a patient in the first 24 hours after injury.

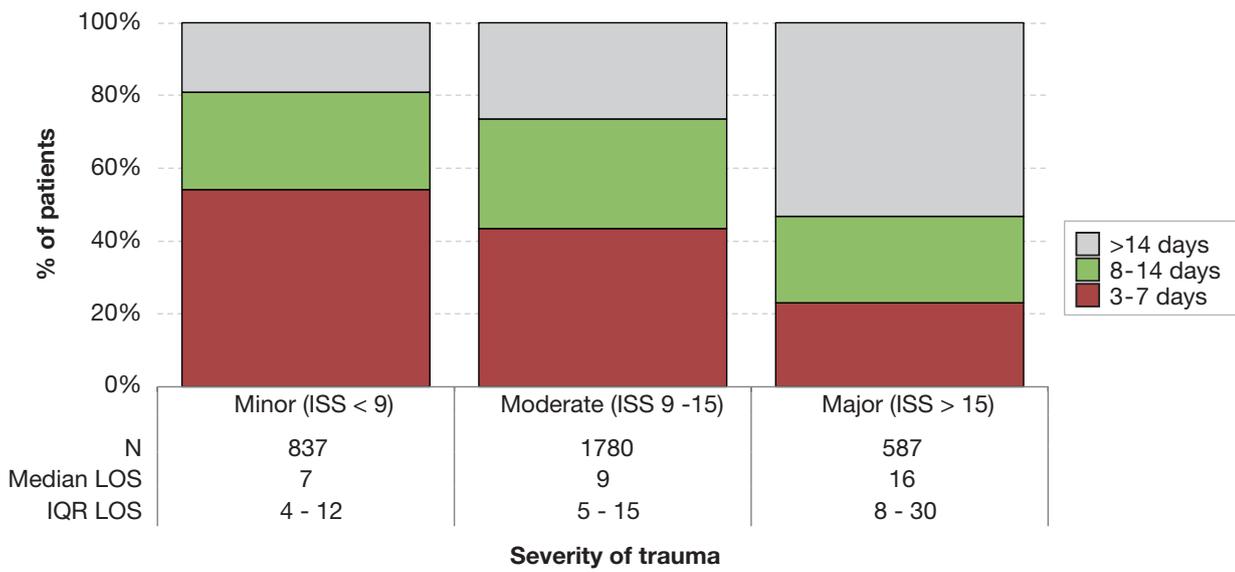
Figure 3.4.2 Days to transfer by severity of trauma (2016)



N: Number of patients.

The majority of major trauma patients (65%) are transferred to another hospital within the first 24 hours. The introduction of the STN next year will change the pathway for these patients, as following triage by the SAS, these patients will be taken directly to a MTC, if they are within 45 minutes travel time, rather than at present, taken to their nearest hospital.

Figure 3.5.1 Length of inpatient stay, by severity of trauma, for patients who survived to discharge from hospital or for more than 30 days (2016)



N: Number of patients.

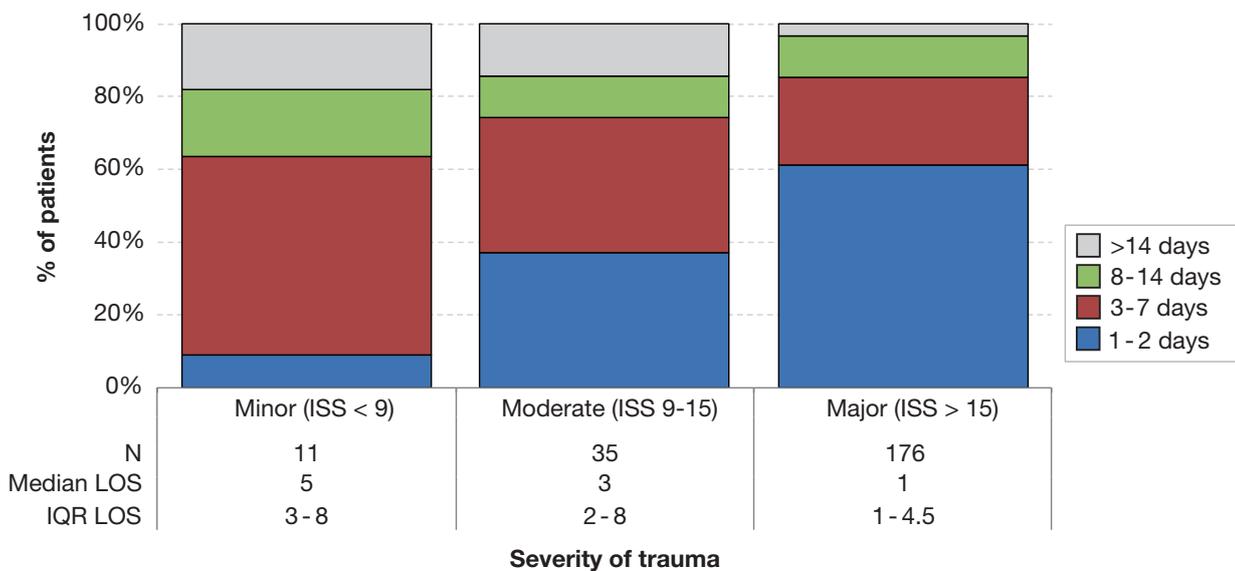
IQR: Inter-quartile range.

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

Figure 3.5.1 shows that more severely injured patients who survive have a longer length of stay (LOS).

These data serve as a reminder that even the “minor” trauma patients have significant injuries and consume large amounts of NHS resources.

Figure 3.5.2 Length of inpatient stay, by severity of trauma, for patients who died in less than or equal to 30 days (2016)



N: Number of patients.

IQR: Inter-quartile range.

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

Patients who died within 15 minutes of arrival in ED are excluded from this graph (N=16).

Figure 3.5.2 shows that of the patients who die following trauma, length of stay is shorter for the more severely injured patients. Patients who die as a result of co-morbidity after admission for trauma are not excluded from the audit. Review of care for these patients continues to be important.

28% of all trauma patients require more than two weeks of inpatient hospital care.

Section 4: Quality Indicators

Scotland’s approach to improving the quality of care that patients and carers receive was set out in The Healthcare Quality Strategy for NHS Scotland⁵ in 2010. It sets out an ambition for health care that is safe, person centred and effective:

Safe - There will be no avoidable injury or harm to people from healthcare, and an appropriate, clean and safe environment will be provided for the delivery of healthcare services at all time

Person-Centred - Mutually beneficial partnerships between patients, their families and those delivering healthcare services which respect individual needs and values and which demonstrates compassion, continuity, clear communication and shared decision-making

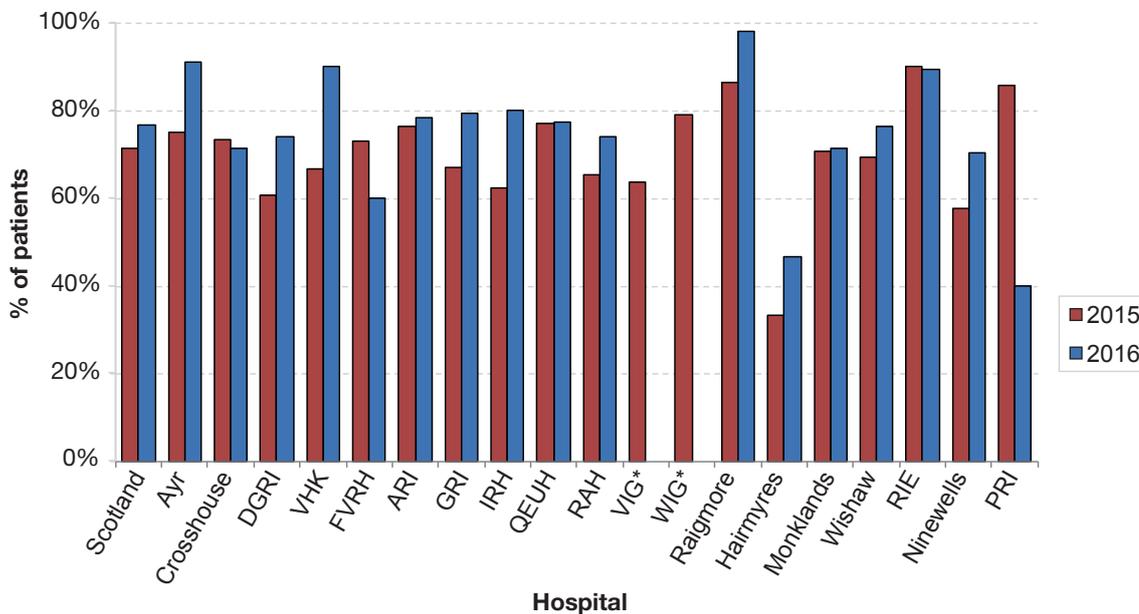
Effective - The most appropriate treatments, interventions, support and services will be provided at the right time to everyone who will benefit, and wasteful or harmful variation will be eradicated.

The STAG QIs were developed in 2012 and new KPIs will be rolled out later this year; aiming to ensure that STAG data are used to drive improvement with these ambitions and ensuring that the care and treatment received by injured patients is of the highest standard.

Compliance with Quality Indicators

This is the third year that STAG have published the results of the compliance with QIs at hospital level. A list of hospital abbreviations used in the charts included in this section can be found in Appendix two on page 41.

Figure 4.1 Percentage of major trauma patients who were pre-alerted, by hospital (2015 and 2016)



Note: This definition is based on the current Quality Indicators used by STAG. Full details can be found at www.stag.scot.nhs.uk.

* Victoria Infirmary, Glasgow and Western Infirmary, Glasgow closed in May 2015.

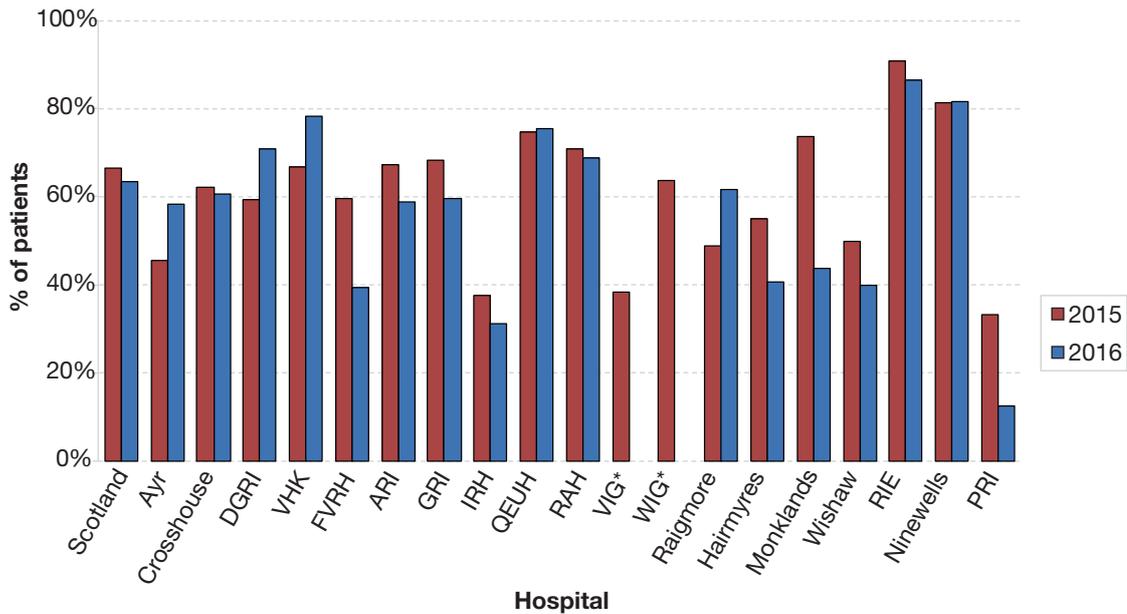
Graph only includes major trauma patients who arrived by SAS, N= 463 in 2015 and 514 in 2016.

A pre-alert by the SAS allows trauma teams to be assembled prior to the arrival of the patient, and may improve the care they receive in the initial stages of their hospital journey⁶.

Figure 4.1 shows that 77% of patients with major trauma patients were pre-alerted in 2016 compared with 71% in 2015. There continues to be wide variation between hospitals with a range of 40-98% in 2016.

The introduction of the SAS Trauma Triage Tool aims to identify patients with suspected major trauma, which then triggers a pathway of care that includes pre-alerting the receiving hospital. Use of this tool is one of the new STN KPIs and STAG will report these data directly to SAS after the introduction of this tool in 2018.

Figure 4.2 Percentage of major trauma patients who were seen by an Emergency Medicine Consultant within one hour, by hospital (2015 and 2016)



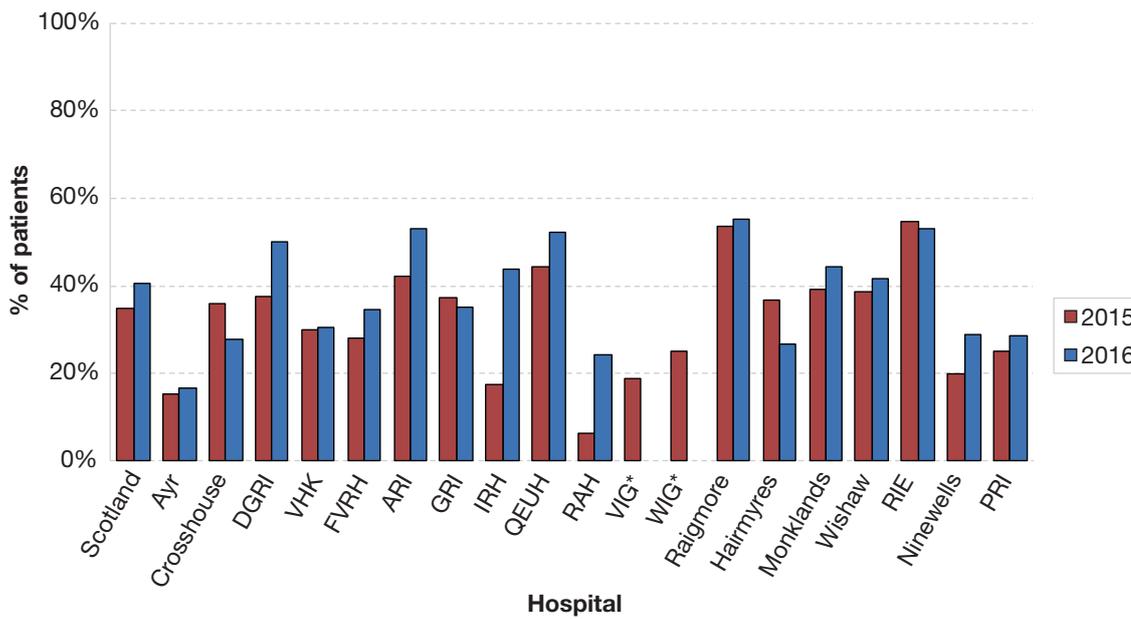
Note: This definition is based on the current Quality Indicators used by STAG.

* Victoria Infirmary, Glasgow and Western Infirmary, Glasgow closed in May 2015.

The percentage of major trauma patients being seen by an Emergency Medicine consultant within one hour has decreased from 67% in 2015 to 64% in 2016 and again there is wide variation between hospitals (13-86%). The number of patients seen by a consultant was 485 in 2015 and 481 in 2016.

STAG recommend ongoing systematic review of care and the implementation of changes in practice if needed.

Figure 4.3.1 Percentage of patients with a GCS \leq 8 and/or severe head injury that had a head CT scan within one hour, by hospital (2015 and 2016)

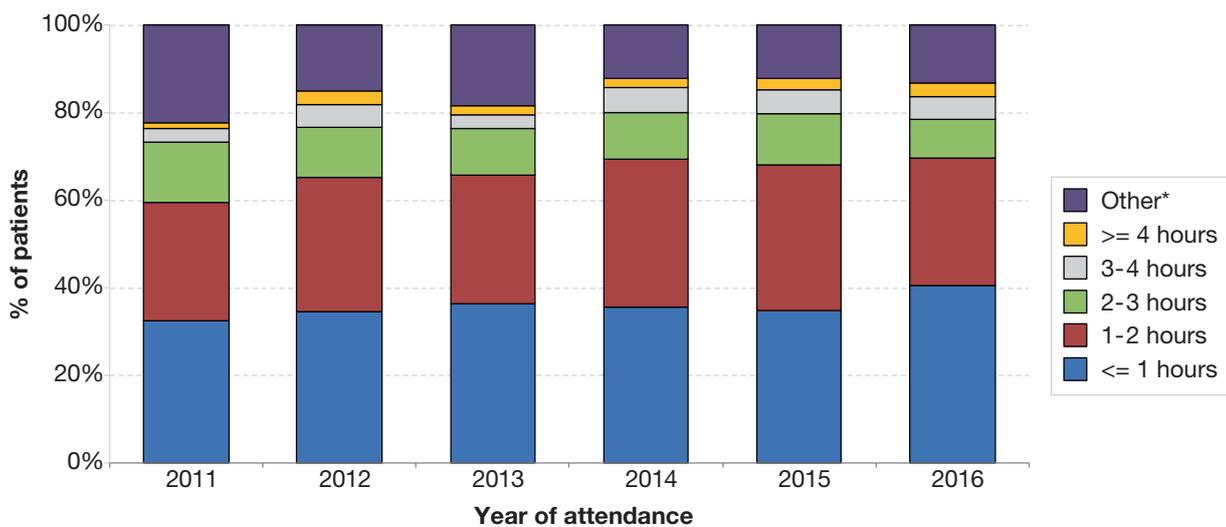


Note: This definition is based on the new Key Performance Indicators (KPI) that will be introduced in 2017. See Appendix one for more details.

Severe head injury is defined as a patient with an Abbreviated Injury Score (AIS)⁷ (head) \geq 3.

Figure 4.3.1 shows compliance with one of the new KPIs that will be adopted after eSTAG is launched. During 2016, 41% of patients with severe head injury had a CT scan within one hour. Between the seven sites which recorded ten or more such patients the range was 29-55%. These findings are similar to previous years and indicate that there has been no consistent improvement overall and that substantial divergence of practice between centres remains.

Figure 4.3.2 Time to CT head for patients with a GCS \leq 8 and/or severe head injury (2011-2016)

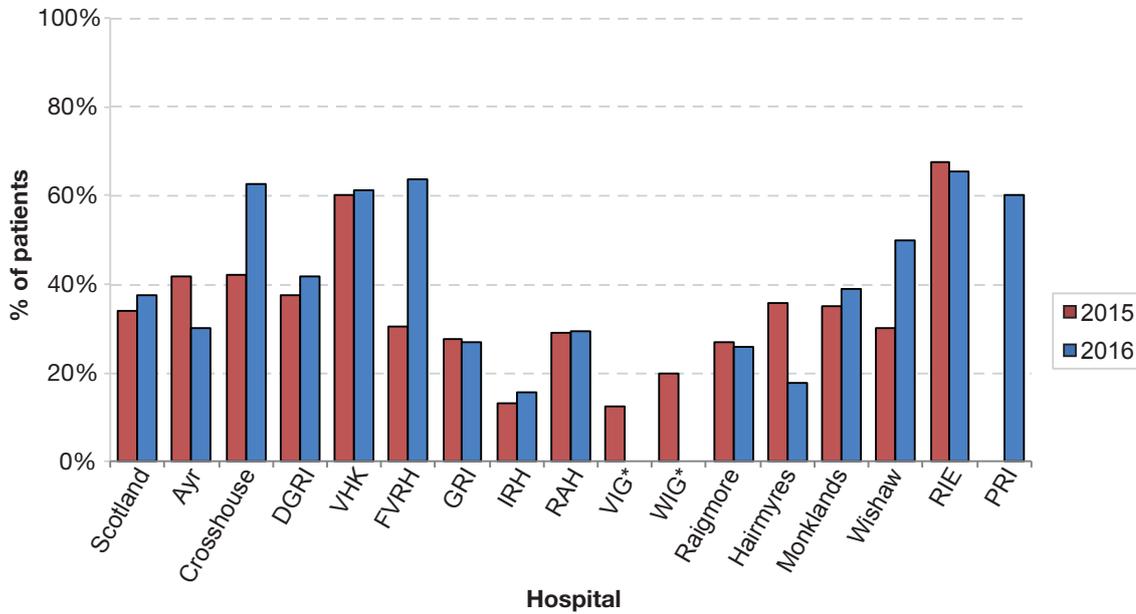


Note: Severe head injury is defined as a patient with an AIS⁷ (head) \geq 3.

* Other includes No head CT scan in ED, Head CT scan in ED but timing unknown and Unknown if head CT scan was performed.

Compliance with the one hour target remains low (Figure 4.3.1) at 41% in 2016, however figure 4.3.2 shows that the majority (70%) of patients with a severe head injury in 2016 received a CT scan within two hours of presentation.

Figure 4.4.1 Percentage of patients with a severe head injury who were transferred to a setting with 24 hour access to a Neurological ICU, by hospital (2015 and 2016)



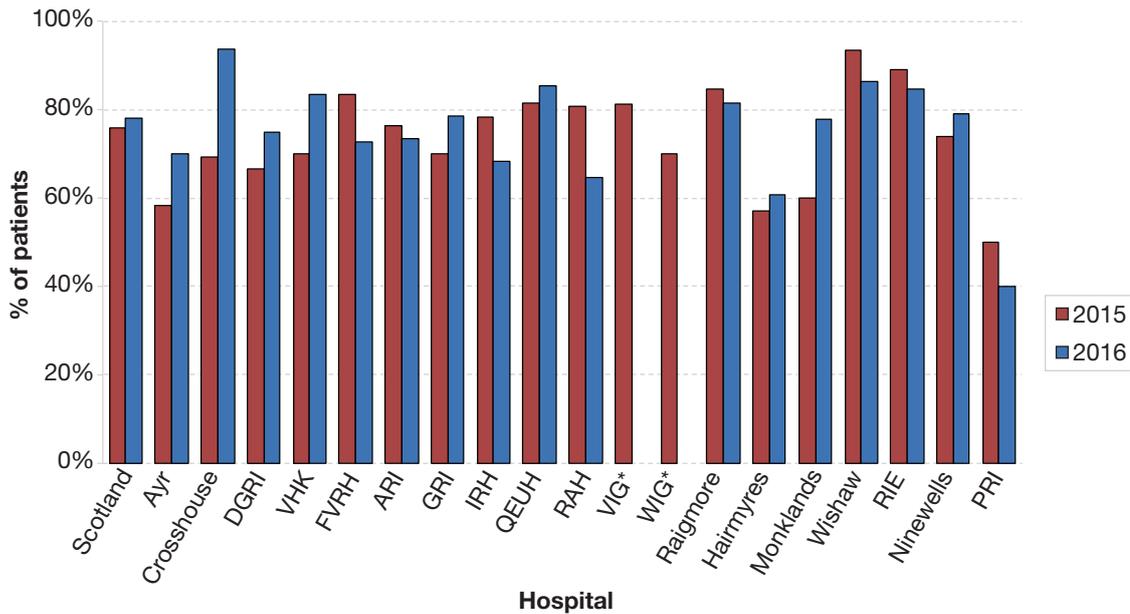
Note: Severe head injury is defined as a patient with an AIS⁷ (head) ≥ 3.

Three hospitals have onsite neurological Intensive Care Unit (ICU) facilities and the current dataset does not allow STAG to determine which patients in these hospitals were managed by the Neurological specialty therefore they have been removed from Figure 4.4.1.

37% of patients with a severe head injury were transferred to a setting with 24 hour access to a Neurosurgical ICU, in 2016, a slight increase from 2015 (34%).

Following the introduction of the STN, recommendations are that patients with a severe head injury are managed in a MTC.

Figure 4.4.2 Percentage of patients with a severe head injury who had a neurological specialist referral whilst in the ED, by hospital (2015 and 2016)

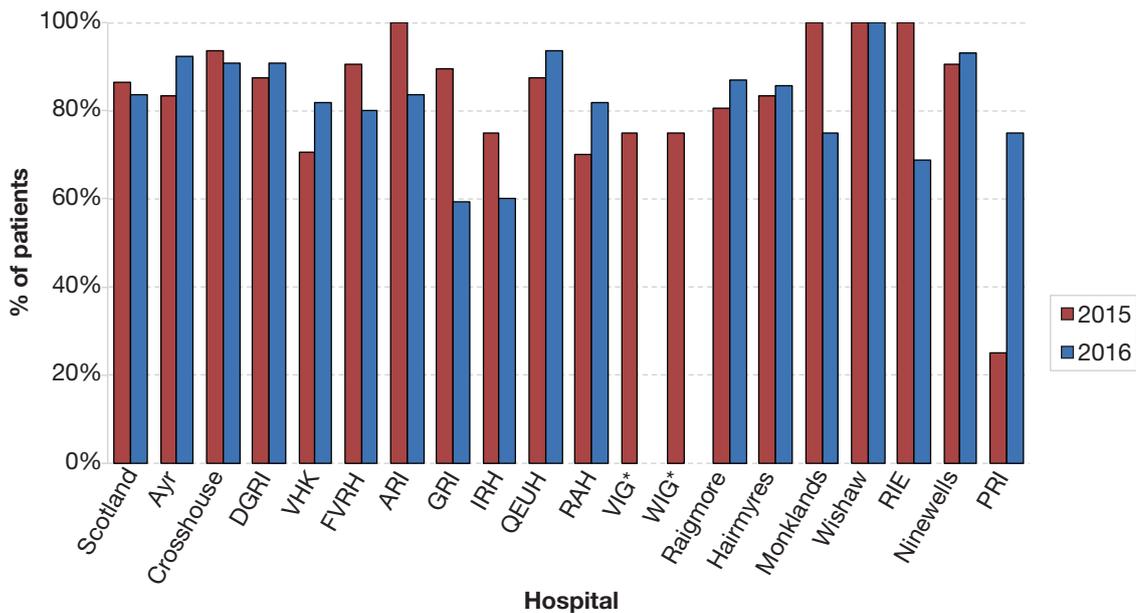


Note: Please note this is not a QI but supplements the information in Figure 4.4.1. Severe head injury is defined as patient who has an AIS⁶ head ≥ 3

Severe head injury is defined as patient who has an Abbreviated Injury Scale (AIS)⁶ head ≥ 3 . Figure 4.4.2 shows that 78% of patients with a severe head injury had a neurological specialist referral while they were in the ED.

Please note that AIS codes are applied retrospectively once all tests including imaging have been completed. The significance of the injury may not always be immediately apparent whilst the patient is in the ED.

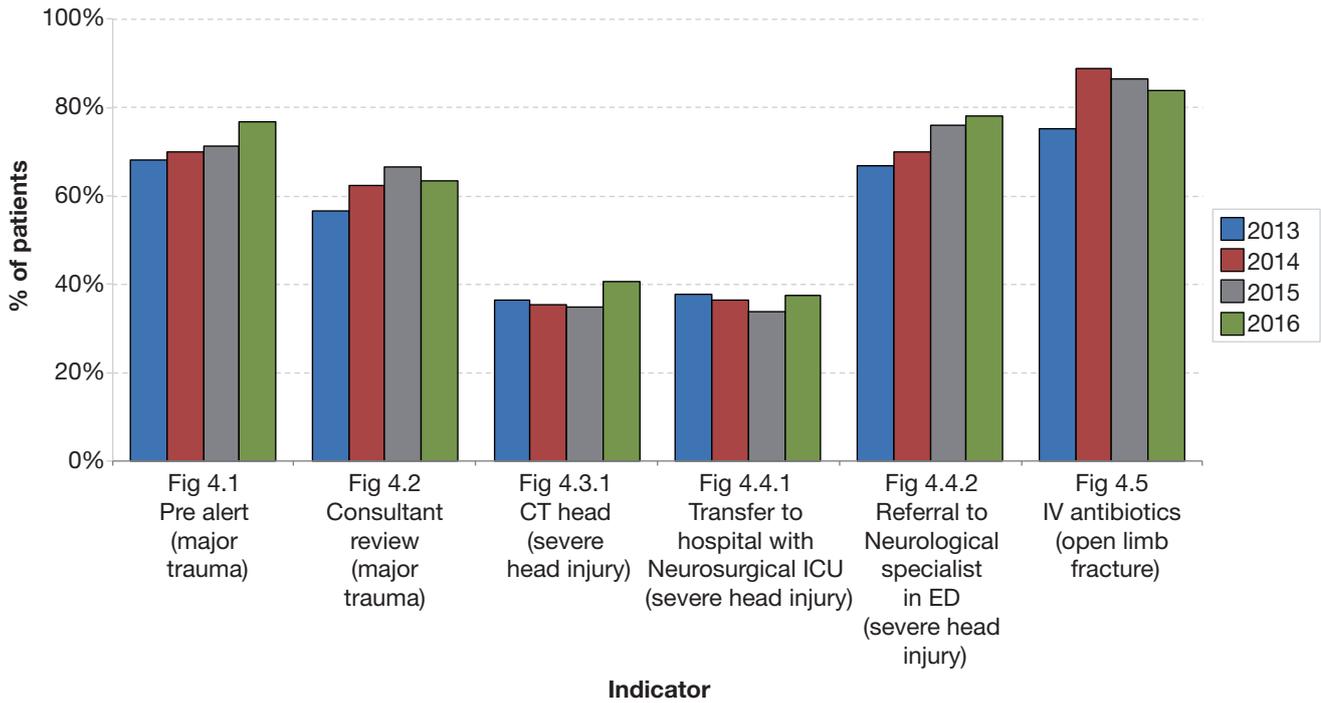
Figure 4.5 Percentage of patients with an open limb fracture who received intravenous (IV) antibiotics within three hours, by hospital (2015 and 2016)



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

Scottish compliance has fallen slightly from 87% in 2015 to 84% in 2016.

Figure 4.6 Summary of Scottish compliance with Indicators (2013-2016)



There is variability across the country with all QIs and Health Boards should strive to improve access to high quality services to ensure the best treatment and support is available to people who have suffered serious injuries.

The next part of this section provides detail of some of the local work currently being undertaken to address this.

Quality improvement for patients with trauma – responses from STAG Clinical Leads

STAG have asked the Lead Audit Consultants responsible for STAG in each contributing hospital to write a short summary of actions that their hospital has taken to improve the quality of trauma care locally.

NHS Fife

Victoria Hospital, Kirkcaldy (Dr Julie Thomson)

We have spent the year consolidating the previous year's work with the trauma team instigation; new paperwork and regular feedback with the SAS on cases received as a standby or thought to require a standby but not given. We continue to review each STAG patient entered into the database monthly with our LAC and liaise with staff to improve awareness of STAG QIs and also feedback on individual cases.

NHS Forth Valley

Forth Valley Royal Hospital (Dr Jo Mitchell)

Activity

FVRH has continued to see a decline in the numbers of patients presenting with major trauma compared with the rest of Scotland, 21% and 15% in 2015 and 2016 versus 23% and 21% nationally. The causes for this are not obvious given that we are sited in an area of Scotland which has a dense population, major road networks, adventure tourism and large scale industrial workings all of which contribute to the production of major trauma.

STAG Quality Indicators

Our Local STAG Coordinator, Julie Watson and I meet monthly to go through our performance and review patients. Any patients requiring more in depth review are placed in the folder for M&M review. Since January 2017, we have started the FVRH Trauma Group in which all of the hospital specialties are invited to hear a presentation of the STAG data, offer opinions and feedback and then we review a clinical case and any associated evidence based learning to improve patient care.

We have noted, in particular, that we are getting less standbys for patients with Major trauma than ever before, 60% in 2016 compared to 73% in 2015. While we are identifying some of these patients and re-triaging them appropriately to resus, we have found if these patients are not identified early then a domino effect exists for the meeting of other QIs. In particular, the delay to consultant assessment has been affected by the reduction in standby calls and under-triage.

In 2016, our departmental Head Injury protocols were updated, including indications for CT by Dr M Kavanagh. This contributed to the improvement in our performance from 28% on 2015 to 35% in 2016 with continued improvement into 2017 so far.

Of particular note was our performance on the W-Stat funnel plot where we fall in at -2SD from the mean. All of the patients that contributed to this statistic have been reviewed. The data in this statistic includes 14 cases from 2015 (which were reviewed following the annual report in 2016) and four from 2016. There were no particular patterns found in the patient groups which included massive intracranial haemorrhages, massive haemorrhage, chest injuries in patients with significant co-morbidities and young trauma patients who presented in cardiac or peri-arrest.

Quality Improvement

FVRH is committed to quality improvement and we have identified several areas which we are focussing improvement on:

1. **Monthly Trauma meetings** have been re-instated as a way of disseminating STAG data hospital wide and discussing trauma in a case based way striving to improve trauma pathways in FVRH. These meetings also serve to unite and engage clinicians to discuss problems with pathways and look at ways to resolve those conflicts.
2. **Trauma Education** is being delivered through the trauma meetings and in-situ simulation in the department, run by Dr R Alcock.
3. **Trauma Awareness**, with screensaver reminders on the departmental PC's
4. **Improvement in Trauma flow**, by introduction of a "Trauma Sticker" with guidance on when to move patients to resus with suspected major trauma. The sticker also adds as an aide-memoir which is mapped to STAG indicators.
5. **Earlier identification of less obvious major trauma.** It has become apparent that SAS triage tools and clinicians are not very good in identifying major trauma in high risk groups (such as the elderly) with low velocity mechanisms. We are currently working on the development of a tool to try and overcome this problem, especially moving towards the future of Trauma Networks.

We intend to present some of our quality improvement work to contribute towards quality improvement in Scotland.

NHS Greater Glasgow and Clyde

Queen Elizabeth University Hospital, Glasgow (Dr H Smith, Dr C McGroarty, Dr S Ahmad, Mr M Gordon)

Education

Bimonthly trauma meetings

The bimonthly meetings continue to run at the QEUH and involve several peripheral sites who may transfer patients to us including FVRH, Arran, Elgin and Oban. Other units within the West of Scotland network have attended or participated including RAH, Hairmyres and GRI. EMRS continue to participate and present at these meetings.

Middle Grade Teaching

There is quarterly teaching for our middle-grades involving a review of trauma cases in preceding months. This will be supported by Radiology from August 2017 onwards.

Simulation

3 in-situ trauma simulations have been run in the ED and lessons learned have been presented at the trauma meeting. Registrars also receive trauma simulation training as part of their weekly teaching programme.

Skills & Drills

There is a skills & drills session per month on an aspect of trauma management.

Audit

There have been audits of particular sub-sections of the STAG cohort:

Whole Body CT (WBCT) – All patients who underwent WBCT for trauma in the first year of QEUH

opening had their images reviewed. Only 14% of those patients who had a WBCT for trauma had no injuries detected on CT. Rates for comparable units in England showed 38 – 57% to have no injuries on WBCT.

Missed Injuries – This initial study inevitably led us to the question – are we scanning too few patients? 14% of our seriously injured patients (n=122) were found to have injuries which were not detected in the ED. The majority of these injuries were peripheral, only one patient required operative intervention (olecranon fracture) and none were life threatening. Half of the patients who had subsequently detected injuries had had a WBCT on presentation; therefore our comparably lower rate of WBCT in trauma does not appear to be resulting in significant misses.

“Incidentalomas” – The next question raised was what do we do about incidental findings? It transpires all findings requiring actions (i.e. further intervention or imaging) are completed. GPs are not consistently informed of either findings or further interventions.

CT Reporting – Radiology are auditing reporting of CTs performed for trauma. The first loop is completed, and following the intervention, results are due to be presented in November 2017.

Hypothermia & Blood Transfusion – A second cycle of this audit was completed. Adaptations have been made to our process in response to the first cycle of this audit and median temperature on departing the ED was higher. No statistical analysis could be performed on this study as numbers were so low. It is now accepted that all trauma patients are hypothermic until proven otherwise and we anticipate re-warming in each case.

Chest Drain Audit – about 30% of patients who had a chest drain inserted for a significant chest injury were noted to have a suboptimal result. Incorrect intercostal space was a common error. Further research into the necessity of all drains is being undertaken.

Head Injury Admission Audit - Head injured patients who are not being admitted under neurosurgery are admitted under the ED. The care of these patients continues to be audited.

Deliberate Self-Harm (DSH) & Trauma – 10% of seriously injured patients sustained their injuries through DSH.

Trauma Call – Compliance of triggering of trauma call activation against indicators continues to be audited.

Case Review

As per STAG guidance, all major trauma cases and trauma cases who did not survive have a case note review within the department. Those considered educational are highlighted as potential cases for discussion at the Trauma Meeting. All trauma deaths with > 50% probability of survival are reviewed in the ED morbidity and mortality meeting in detail. A summary is given of all trauma-related deaths regardless of their likelihood of survival.

Process

Trauma booklet – A new trauma documentation booklet is being employed & compliance with its use is good. There are steps in place to develop a debrief tool after trauma calls.

CT Reporting – As mentioned, Radiology are looking at standardising their reporting of trauma imaging in line with the Royal College of Radiology.

Time to CT and Time in CT – There is ongoing work to improve on both of these. While time to CT has dropped, time in CT is highly variable and is being looked at in conjunction with our radiology colleagues.

Royal Alexandra Hospital and Inverclyde Royal Hospital (Dr Niall McMahon)

The quality improvement measures in Clyde are:

- creation of timelines for all major traumas and deaths which are all reviewed and many shared with the treating ED clinicians,
- regular review of STAG data and presentation at clinical governance meetings,
- annual review of all STAG data (IRH),
- multispecialty trauma specific multi disciplinary meetings,
- recommendations to the board regarding wider service changes with an impact on trauma care,
- changes to radiographer working patterns to improve access to CT,
- use of standardised patient packaging including radiolucent scoop stretcher to reduce time to CT, and
- use of STAG data to process map the patient journey to CT to try and reduce delays and improve time to imaging.

NHS Highland

Raigmore Hospital, Inverness (Dr Kirsteen Wintour)

Quality Improvement work for patients with trauma

The single biggest change is the introduction of a functioning hospital trauma team in October 2016. Based on the pre-alert information either a trauma or a 'code red' trauma call is put out by switchboard and we subsequently have anaesthetic, surgical, and orthopaedic specialties attending. We now have a hospital major trauma pathway (redrafted several times!) which is proving useful in standardising and improving the efficiency of patient care – time to analgesia, CT and definitive management.

Several other factors have developed in conjunction with this team response. We have recently introduced an Emergency Department trauma team briefing at the end of the morning 'safety huddle', which includes medical, nursing and auxiliary staff. We now have two X-ray compatible scoop stretchers, and the local ambulance service are in the process of procuring a supply. This will enable us to simply swap over stretchers, rather than move the patient unnecessarily. There are team role stickers with space for people's names. We have a 'line on the floor' in the resuscitation room to facilitate a quiet and identifiable team approach in the trauma situation. After discussion (around buying a level one infuser) and costing we have restocked Ranger HiFlow giving sets, in order to be able to give warm blood more quickly than with the standard giving sets.

As a department we are involved in the revision of the hospital major haemorrhage protocol which is currently underway. We have changed our departmental head injury guidance from SIGN to the more up-to-date NICE guidelines. We have also recently agreed clinical indications for performing cervical spine imaging for Emergency Department patients without a hard collar with our radiographers.

An in-situ simulation programme for the hospital trauma team is in development. There have been US teaching sessions at Consultant teaching to increase our familiarity/competence at FAST and echo FEEL scanning.

On a less positive note, sadly due to a lack of radiology services locally, out of hours trauma scans are currently being outsourced to an online reporting company. This variably has meant

longer times to ‘prescribing’ and/or reporting scans. The exception to this outsourcing is for the unstable trauma patients, when the local radiologist is available. In these cases we feel that the patient receives a better service.

One of our Consultants (Dr Luke Regan) collects data to contribute to the monthly North of Scotland Major Trauma Network ‘Dashboard’. This includes data on; number of trauma calls, mechanism, injuries, interventions, destination, and length of stay. Dr Regan has also been liaising with the local SAS, and search and rescue teams, with regard to management of trauma patients. Information is exchanged, anticipating the upcoming SAS trauma triage tool and promulgating the Raigmore trauma call system.

We continue to:

Hold monthly meetings with STAG local Coordinator and Lead Audit Consultant

Clinical Care group meeting bimonthly

Prehospital programme of expanded team of BASICS responders (PICT)

Ongoing engagement with the Scottish Trauma Network – planning processes and meetings

The European Trauma Course has run locally again this year (for the second time) with different specialties participating. Further Emergency Department staff have been put forward as Instructor Candidates.

NHS Lanarkshire

Monklands Hospital, Airdrie (Dr Barbara Key)

Monklands Hospital continues to review STAG data in the regular ED Clinical Governance meetings e.g. patients who have not met the standard for CT head in one hour. In addition, all trauma deaths are reviewed in the ED morbidity and mortality meeting with those who had a more than 50% probability of survival being looked at in detail. Hospital wide M&M meetings have been set up within the past year, and discussions have been had with the hospital M&M lead about how best to feedback the STAG data to the hospital as a whole. Preliminary discussions were being had regarding regular hospital wide trauma meetings but have been put on hold following the re-organisation of Orthopaedics and Trauma within NHS Lanarkshire. Recurrent issues identified from the STAG QI reports are communicated to the department via the Consultant meetings, email and the daily safety brief e.g. poor documentation of Consultant presence.

A significant proportion of our major trauma patients are head injuries and local policy is that these patients are admitted under the care of the ED team to a medical ward. The LAC continues to do a lot of work to ensure that none of these patients are lost to the audit from administrative errors. Further work is planned to improve the triage of some of our head injury patients, with the subsequent improvement in CT time/ consultant involvement time.

Hairmyres Hospital (Dr Trish O’Connor)

We continue to review pre alerts for major trauma and liaise with SAS staff where appropriate. We are involving our junior staff in departmental STAG audit in an effort to improve QI performance.

Following analysis of data, a number of major trauma patients (usually elderly) incurred a minor fall or minor mechanism of injury while maintaining normal physiology hence failing to trigger a SAS pre alert.

We are currently considering effective strategies for flagging and expediting assessment of such patients (elderly patients presenting with falls is a large group) on the background of

increasing demand on consultant time and staffing limitations (particularly at night time and weekends).

In light of previous STAG data we now endeavour to prioritise senior ED staff to see any trauma patients with a GCS \leq 14.

NHS Lothian

Royal Infirmary of Edinburgh (Dr Dean Kerlake)

Over the last couple of years STAG data in Edinburgh has been incomplete due to unforeseen staffing circumstances and an increase in workload. As a result of this we have recruited two new LACs increasing our whole time equivalent staffing from 0.6 to 1.0.

Our available STAG data has been utilised extensively:

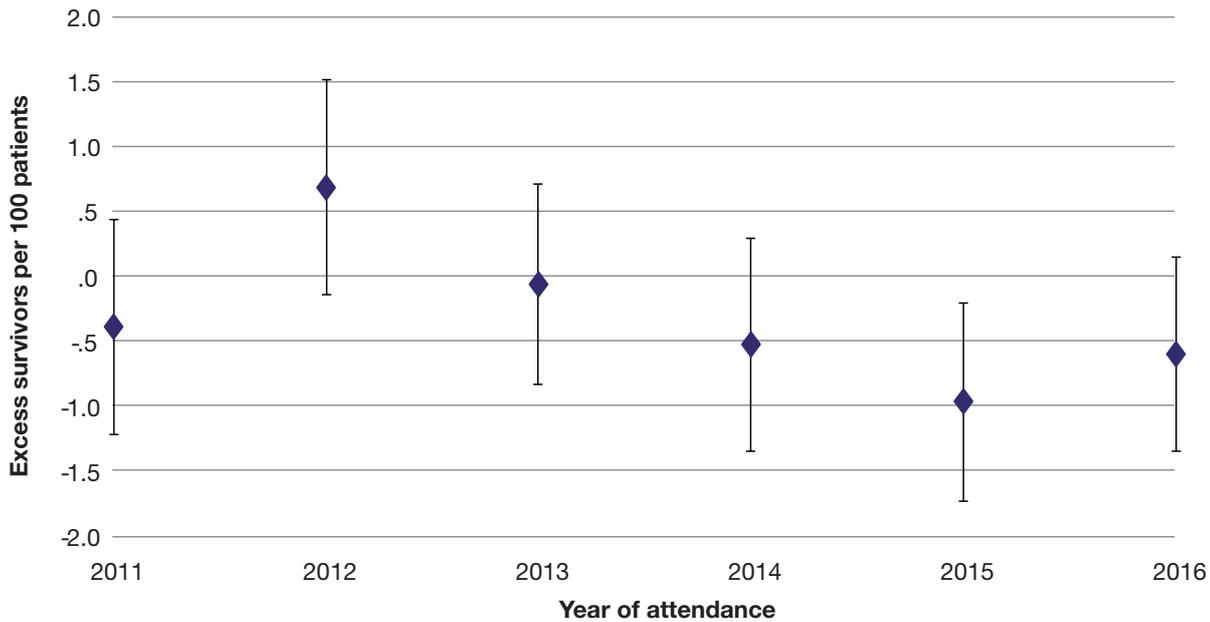
- In the planning of our Major Trauma Centre and Trauma Network regionally.
- To provide identification of mortality and morbidity cases to be discussed at our multidisciplinary Major Trauma meetings; review of which have led to some of the following improvements:
 - Improved access to Pre hospital information for inpatient clinical teams
 - The development of a standardised pre-alert call (to be implemented 2017)
 - Earlier identification and treatment of trauma patients on oral anticoagulants.
 - Pre Hospital, Emergency Department, Trauma team and specialty trauma training days.
 - Reduction in our times to Whole Body CT scans
 - Electronic documentation of provisional CT reporting and specialty advice
 - Development of Head injury and C spine injury imaging, referral and admission guidelines
 - Improvement in Major Haemorrhage pathways
 - Increased awareness of the 'undertriage' of Elderly trauma
 - Ongoing development of clinical guidelines
- Standardised electronic documentation based around STAG data points and Key Performance Indicators.

Section 5: Outcome

In 2016, the crude mortality for patients included in the STAG audit was 6%, rising to 23% for patients with major trauma.

The Revised W-Statistic shows the number of actual survivors compared with the number of expected survivors (using TARN Ps 12 methodology⁸) which allows a better comparison of mortality over time and between different hospitals, as trauma severity and hospital case-mix are adjusted for.

Figure 5.1 Revised W-Statistic: Scotland (2011 – 2016)



Note: The numbers of expected survivors is generated from the TARN database (2010-2013) which includes data on patients who have already been treated for similar injuries. The revised w statistic shows the number of excess survivors per 100 patients.

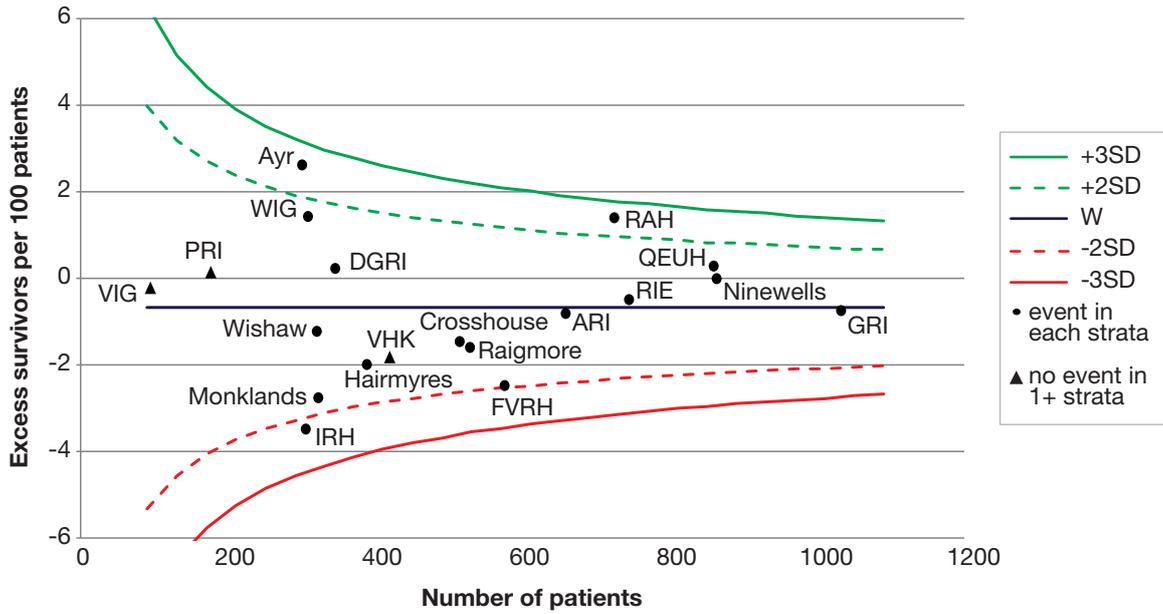
STAG recognise the limitations of analysis that is based on non-Scottish reference data, and the sampling of the patients may not be directly comparable to the methodology used by STAG.

There is no significant change in the Scottish W-Statistic since 2011, when comparing each year with our 2011 baseline.

STAG has aspired to use a Scottish reference population in our audit of trauma care, and we have now reached the point where we have sufficient data to do this. This will ensure that going forward the analyses of these data give the most accurate reflection of change in our trauma outcomes, as we continue to use the data to drive improvement.

The STN is due to go operational in two regions in 2018, with the other two regions following thereafter.

Figure 5.2 Revised W-Statistic: by hospital (2014 – 2016)



Note: The numbers of expected survivors is generated from the TARN database (2010-2013) which includes data on patients who have already been treated for similar injuries. The revised w statistic shows the number of excess survivors per 100 patients.

Victoria Infirmary (VIG) and Western Infirmary (WIG) in Glasgow stopped STAG data collection in May 2015, following the closure of their EDs.

Figure 5.1 shows the Revised W-statistic for all adult hospitals who have contributed to STAG during 2014 -2016 (N = 19).

It should be recognised that in a comparison of 19 hospitals there is a considerable chance of an outlier at the 2 Standard Deviations, and that this result could be found by random chance even when no difference exists.

Being an outlier may also be explained by, different referral patterns, admission policies or resources, standards of care or data quality. STAG have a robust quality assurance process to ensure data are high quality.

Inverclyde Royal Hospital (IRH) is more than 2 SDs for the second year, although it should be noted that the timeframes reported crossover and that the excess deaths has improved from 4.8 to 3.5 per 100 patients. As per STAG Governance policy, their Clinical Leads and Medical Director have been informed of this result prior to publication of this report.

Please note that three hospitals did not have at least one patient in every survival band (illustrated by a triangle) and therefore results should be interpreted with caution. See methodology (page 34) for more detail on analysis.

Section 6: Paediatric STAG data collection

The development of paediatric STAG has been a priority of the steering group and as such pilot of paediatric data collection has been ongoing at the Royal Hospital for Children, Glasgow (RHC) now for two full years. This has allowed STAG to address and make changes to the proposed paediatric data set and evaluate the inclusion criteria, KPIs and validations for this particular patient group.

In the twelve months from June 2015 to May 2016 the RHC had a total of 79 cases that met the STAG inclusion criteria, amounting to <0.1% of the annual attendance of 59483. Similarly 68 cases were included from June 2016 to May 2017 representing <0.1% of the 57319 annual attendance for that year.

We recorded an ISS range of 1 to 51 in the first year and 4 to 75 in the second year's data. 2015 to 2016 audit data shows that 24% of patients were classified as major trauma, 57% as moderate and 19% as minor. 2016 to 2017 data shows 31% were major trauma, 49% moderate and 21% minor according to ISS classification. 99% of patients attended ED between 8 am and midnight.

In addition to pilot data collection, a scoping exercise has been completed looking specifically at the excluded (i.e. admitted for less than 3 days) under one year olds for the first twelve months of data collection at RHC. This work has focussed on the current inclusion criteria and whether it is fit for purpose for this age group, given the injury patterns and aetiology we see in this population.

16 cases that did not meet the inclusion criteria were reviewed. Of these, 82% sustained a skull fracture with the remainder being a mixture of intracranial bleeds without skull fracture and isolated long bone fractures. There were no cases of multi-region trauma. None of this cohort had an ISS >15 meaning there were no cases of major trauma in this group.

25% of this cohort underwent child protection investigations as per policy in comparison to 18% for all age groups included in the audit over the same time frame. The excluded under ones had a 6% rate of proven non accidental injury (NAI) in comparison to 8% in all age groups included in the audit for the same time period. The steering group concluded that the available data did not provide evidence to support a change in the inclusion criteria for under 1s at the present time however, RHC are continuing to review this group.

Both the Royal Aberdeen Children's Hospital and NHS Tayside have commenced paediatric data collection this year with all other sites due to commence paediatric data collection following the introduction of eSTAG later this year. This will allow a more representative and national picture of paediatric trauma in Scotland in the future.

STAG update on key priorities

Key recommendations for STAG

The National Planning Forum (NPF) report on major trauma provision⁹ made a series of recommendations for the future of trauma data collection provided by STAG in view of establishing a STN:

1. Mandatory participation

At the time of writing this report (October 2017) there are 30 hospitals with an ED in Scotland and 21 of these hospitals now contribute data to STAG. STAG are working with the remaining hospitals and regional networks to ensure participation in STAG in the near future.

2. Include paediatric patients with trauma

The NPF highlighted paediatric trauma in Scotland as a priority making this an exciting time to move forward with the expansion of STAG to include the whole paediatric population (under 13 years).

In 2017, The Royal Aberdeen Children's Hospital and NHS Tayside started to collect data on paediatric patients. The Royal Hospital for Sick Children in Edinburgh plan to start data collection soon and all other hospitals will start to collect data on paediatric patients after the introduction of eSTAG.

3. Key Performance Indicators (KPIs)

A subset of the KPIs will be reported after the introduction of eSTAG. Others rely on the Trauma Triage Tool and Major Trauma Centres being established and therefore will start when these are progressed. These indicators will adapt over time, following review of the data. See Appendix one (page 38) for the full list of indicators.

4. Rehabilitation

Two of the KPIs are related to rehabilitation with the introduction of formal planned care using a National Rehabilitation Plan for major trauma patients who are admitted to a MTC.

5. Patient Reported Outcomes Measure

In order to improve trauma services and assure the public that the STN is achieving its aim of reducing mortality and improving quality of life, STAG will continue to report mortality data and begin to collect and report on functional outcome and quality of life outcomes.

Patients may survive their injuries, but be left with long-term disabilities therefore improving functional outcomes and quality of life should be regarded as equally important when considering the effectiveness of trauma care.

STAG will use PROMS² in order to gather data on functional outcome and quality of life and work is progressing to introduce these measures in 2018, following secured funding from the Scottish Government.

6. Data linkage

STAG have progressed data linkage with the SAS in order to report on the KPIs and allow for more robust information on pre hospital care for trauma patients.

STAG now routinely link with ISD datasets to provide more information on trauma patients allowing STAG to widen the scope of its reports in future without the need for further data collection.

All linkage of NHS and Social Care data requires additional permissions by the Public Benefit and Privacy Panel for Health and Social Care³ and strict processes and protocols need to be adhered to.

STAG are also progressing other key objectives to ensure that the audit focuses on improving effectiveness and works more efficiently to support local hospital staff in order to improve outcomes for patients:

eSTAG

In order for STAG to fulfil the recommendations of the NPF it is essential that electronic data collection and reporting is implemented. STAG are currently working with staff from the National Services Scotland Information Technology Strategic Business Unit and it is estimated that eSTAG data capture element will be live in November 2017, resulting in a more efficient process for data collection, validation and improved access to data for local clinicians. This will allow timely local review of performance against KPIs, facilitating improvement in service delivery and patient care within hospitals.

Governance Process

The introduction of a robust governance process is essential in order to support hospitals with improvement and a working group has been set up to progress this objective. A process for reviewing hospitals that have a mortality rate that is statistically higher than the Scottish mean is now established and other governance processes are being discussed with our colleagues from the STN National Services Division team.

Use of STAG data in research

The STAG research subgroup has two main objectives:

1. Coordinate the academic activity undertaken using STAG data; and
2. Facilitate the development of academic capacity.

The group has developed robust structures for processing requests for STAG information, in line with other ISD policies to ensure a timely and well governed response to data requests. Along with this, a process has been put in place to ensure scientific validity of requests, supported by STAG analyst time. All data recipients are now required to give formal feedback on how the data released to them has been used. The time from request to data release has been significantly shortened and, pending appropriate governance arrangements, data release is happening in a short timescale.

In the last year, a total of 13 data requests have been processed. STAG data has been used to support publications in the *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* and *The European Journal of Emergency Medicine*. Data from research projects using STAG data has been presented at the annual national STAG meeting, along with other national meetings. In the past 12 months STAG data has been used to support higher professional qualifications for paramedics from the Scottish Ambulance Service, as well as medical staff.

The research group aim to continue to support our core objectives while expanding the value available from the STAG data.

Dr Alasdair Corfield

Chairman

STAG Research Group

Conclusion

STAG has a world-class trauma database that holds information on over 20,000 patients who were treated during 2011 – 2016. These data are being used for future planning of trauma services; and driving improvement and research in this patient group.

The 2017 report concentrates on 3442 patients who were treated in 17 hospitals during 2016. An overview of paediatric patients treated in the RHC can be found in Section 6. Although the database already covers the vast majority of the population of Scotland, there is still some work to be done to complete the picture over the next year.

The new electronic data collection system, eSTAG will provide timely data with accessible reports through the interactive data visualisation tool Tableau, allowing each hospital, NHS Board or Regional Network to see their own performance against the STN KPIs.

STAG will begin to report on some of the KPIs after the launch of eSTAG in November, with others being introduced following the implementation of the SAS Trauma Triage Tool and the Major Trauma Centres being operational.

The overall mortality rate for patients included in STAG is 6%, rising to 23% for the major trauma patient group (ISS>15). In 2014 – 2016 all hospitals mortality rate is within the expected range (< 3 SD from the mean), using the W-Statistic to compare expected mortality against actual mortality.

STAG has not found any significant change in the Scottish W-Statistic since 2011, when comparing each year with our 2011 baseline.

The introduction of our PROMs² programme in 2018 will give valuable information on functional outcomes and quality of life for patients who survive trauma. This programme has been funded by the Scottish Government for five years.

There is a need to further improve sharing of good practice, as the most striking note to make about the performance against the QIs is the wide variation between hospitals. The changes to the pathway for patients with major trauma will ensure that they are quickly delivered to definitive care from a specialist multi-disciplinary team.

The STN will hold a two day conference in Edinburgh on the 18th and 19th January; and will include presentations on the use of STAG data for quality improvement and research. We hope you can join us at this event. More details will follow soon on the [STAG](#) and [STN](#) websites.

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Abbreviations

AIS	Abbreviated injury scale
BASICS	British Association of Immediate Care
CT	Computerised tomography
ED	Emergency department
EM	Emergency Medicine
eSTAG	Electronic data collection tool, STAG
GCS	Glasgow coma scale
HQQ	Healthcare Quality Quest
ICD10	International Statistical Classification of Diseases and Related Health Problems 10th Version
ICU	Intensive Care Unit
IQR	Interquartile range
ISD	Information Services Division
ISS	Injury severity score
IV	Intra venous
KPI	Key Performance Indicator
LAC	Local Audit Coordinator
MTC	Major Trauma Centre
NHS	National Health Service
NSD	National Services Division
PHI	Public Health and Intelligence
PROMS	Patient Reported Outcome Measures
Ps12	Probability of Survival 12
QI	Quality Indicator
SAS	Scottish Ambulance Service
SHA	Scottish Healthcare Audits
SIU	Spinal Injuries Unit
SMR01	Scottish Morbidity Record 01
STAG	Scottish Trauma Audit Group
STN	Scottish Trauma Network
TARN	Trauma Audit and Research Network
TU	Trauma Unit
TXA	Tranexamic acid
WBCT	Whole body CT

Methodology

Data Collection

STAG has a team of LACs who are employed by the participating Health Boards to identify patients, collect data and feedback results to their local sites. Data were collected by LACs in each of the participating sites.

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 systems and results of diagnostic imaging and surgical procedures.

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

From November 2017, data will be collected via eSTAG, a bespoke electronic data collection system, improving the efficiency of this process and allowing quicker access to data and reports for clinicians and managers.

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 within the previous seven days requiring an inpatient stay of at least three days or who die during their inpatient episode.

[Inclusion Criteria](#) is reviewed regularly to ensure STAG are capturing all patients who have had a significant injury. A recent amendment is to include all patients admitted to a Critical Care Unit, irrespective of their length of stay. All Paediatric patients will be included following the introduction of eSTAG.

Patients are followed up for 30 days, or until death or discharge within these 30 days.

Injury Coding Dictionary

During the period described in this report the 2005 Abbreviated Injury Scale (AIS) dictionary (2008 update)⁶ was used to code and score patient injuries. STAG started using this version in January 2013 having previously used AIS 1990 Revision, Update 1998.

Quality assurance

A high standard of data quality is essential to ensure the STAG database is accurate, consistent and comparable across time, and between hospitals. This will ensure decisions to improve quality of care and service provision at hospital, Health Board and national level are based on correct information. Without quality data it would be impossible to interpret results with any accuracy or conviction.

The data quality processes undertaken by STAG are incorporated into the following:

At point of data collection/proforma completion;

Central validation; and

Quality Assurance visits to each site at least once a year.

At point of data proforma completion

LACs carry out data quality checks prior to submitting the proforma to the STAG Central office. Once submitted, further data quality checks are carried out prior to data being entered into the central database.

Central Validation

All data are subject to a computer based validation process using IBM SPSS Statistics 21. All queries are raised and LACs provide confirmation or correction of the query. Monthly validations are collated and sent out to the LACs. Any issues with data fields are queried, and any changes to the data are fed back to central office for corrections to be made.

Central validation processes are being developed to separate proforma errors (that must be corrected) from proforma warnings (checks where the information does not seem correct, but may be accurate and not require to be corrected) when feeding back information to LACs. This will allow identification of any data quality issues more effectively.

Quality Assurance visits to each hospital at least once a year

Data collection processes are quality assured by the Quality Assurance Manager and/or Regional Coordinators during sites visits and includes assessment of individual site's case ascertainment rate. A random sample of ten validated cases is generated from the STAG dataset. The algorithm selects the sample data including major and/or moderately injured patients, covering a specific timeframe to guarantee that enough cases are quality assured for each STAG site during the visit. Any data quality findings are reported back to each site and amended if appropriate.

Missing Glasgow Coma Scale (GCS)

The first observation of the GCS recorded on arrival to the STAG ED is used to calculate the Ps 125. Where this is not available, the last observation recorded by the SAS, or the first within the first hour of arrival to the STAG hospital are used. In the event that no GCS is available from these three sources, a 'normal' GCS score of 15 is allocated. A normal value of GCS was allocated in 145 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. If the patient was intubated, an accurate GCS cannot be recorded. TARN advise that 'intubation' needs to be used as predictor in the Ps 12 calculation where GCS is missing. Each instance of this was investigated by the relevant LAC, including proactive education on the impact of the use of allocated values in an attempt to improve the availability of a GCS.

Interpretation of Statistics

STAG data are subject to ongoing validation and must be regarded as dynamic. Therefore, if this analysis was to be re-run at a later stage it may be subject to change.

Probability of Survival

STAG use a logistic regression model developed by TARN (Ps 12⁵) to determine probability of survival for each patient. This is a population based statistic which uses the patient's age, gender, GCS, a transformation of Injury Severity Score⁴ (ISS) and an interaction between age and gender to determine whether a patient would normally be expected to survive. Ps 12 is a mathematical calculation which gives an indication of the probability of survival and not an absolute measure of mortality⁸.

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. Observed survival is compared to expected survival. A positive W-statistic indicates unexpected survivors, whereas a negative W-statistic indicates unexpected deaths. The W-statistic is standardised with respect to injury severities to allow case-mix variation amongst hospitals.

When the number of eligible cases in each survival group is small, the estimated rates may be unreliable because the direct standardisation is very sensitive to small numbers.

It is important to realise that TARN prediction model Ps 12 does not consider pre-existing medical conditions. In 2014 TARN has recalculated the logistic regression coefficients and developed a new version for calculating probability of survival, Ps 14 which includes pre-existing medical conditions of patients. They have recently updated this to Ps 17 and STAG will start using this model in November 2017, in conjunction with the implementation of eSTAG. Including this additional information will improve the accuracy of the outcome prediction model.

Funnel plots

To show the differences between hospitals, Figure 5.2 is shown as funnel plots.

In a funnel plot, a performance indicator is shown on the y-axis, while the numbers of admissions are shown on the x-axis. There is a data point for every hospital in the funnel plot. Furthermore, the plot shows the Scottish mean as a horizontal line across the number of admissions.

The funnel plot also shows confidence intervals for the performance indicator across the number of admissions. As the confidence intervals get smaller, the numbers of admissions get larger and the shape of a funnel appears. Hence the name funnel plot.

When a hospital's performance indicator falls outside the confidence intervals, that hospital might be different from the rest. The inner curves correspond with 2 standard deviations (2 SD) from the Scottish mean, while the outer curves correspond with 3 standard deviations (3 SD) from the Scottish mean. Hospitals whose performance indicator is outside the outer confidence interval are considered to be different from the majority of other hospitals. Differences may arise from many sources: differences in data accuracy, case-mix, service provision or practice. Sometimes a difference is just a random difference caused by chance alone.

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.

STAG Quality Indicators

The use of QIs in the trauma patient journey is to identify patients who have not had the optimal journey for local review maximising learning and improving patient care through use of the audit data.

If a QI 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 a QI has not been met does not infer that the management of the patient has been sub-optimal however this should be considered. Often 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.

Hospitals receive this information on a monthly basis in order to review the cases when staff are likely to remember details about the patient journey.

Appendix one: Key Performance Indicators for the Scottish Trauma Network

The KPIs have been agreed to help monitor the system as a whole and, over time, drive its ongoing development and improvement. Furthermore, the KPIs themselves will be reviewed and updated regularly, to ensure that they are fit for purpose and capture the necessary information.

Each indicator has a description explaining the performance to be achieved and a rationale as to why it is considered to be important.

Pre Hospital Care: encompasses the response from the call alerting the emergency services, to on-scene care, triage and primary transfer.

1.1 Pre hospital Triage	
Description	Patients who have suffered significant trauma are assessed by the SAS using the SAS Trauma Triage Tool.
Rationale	The Trauma system relies on the need of the patient and the capacity of the service being matched and triage will help deliver this.
1.2 Pre alert	
Description	Patients who are triaged as requiring Major Trauma Centre (MTC) care are notified to the receiving hospital (pre alert).
Rationale	Pre-alerts allow trauma teams to be assembled prior to arrival of the patient, improving the care they receive in the initial stages of their hospital journey.
1.3 Diversion to lower level of care	
Description	Patients who are triaged as requiring MTC care are taken directly to a MTC if they are within 45 minutes travel time.
Rationale	The aim of the trauma system is to deliver patients to definitive care, whenever possible; to provide safer care, decrease mortality and improve functional outcome.

Early hospital Care: Early hospital care includes initial reception of the patient in the ED and inter-hospital transfer (if required), through to the patient being discharged to a rehabilitation service or home.

2.1.1 Consultant led reception for patients triaged and taken to MTC care	
Description	Patients who are triaged and taken to MTC care are received by a consultant led trauma team.
Rationale	A consultant will have the necessary expertise and experience to effectively coordinate the initial assessment and treatment of a major trauma patient.
<i>Paediatrics</i>	Paediatric Emergency Medicine Consultant: Same definition as adult from 8.00-23.59. Seen by a consultant within 30 minutes from 00.00 to 7.59.
2.1.2 Consultant review for patients triaged to MTC care and taken to a Trauma Unit (TU)	
Description	Patients who are triaged to MTC care and are taken to a TU should be seen by a consultant within 60 minutes of arrival.
Rationale	As 2.1.1

2.2 Time to Major Trauma Centre care	
Description	Major trauma patients who are not taken directly to a MTC and are later transferred to a MTC are transferred within 24 hours.
Rationale	Some patients with major trauma will not be taken directly to a MTC due to a number of reasons including prolonged distance to a MTC, unstable clinical condition, under triage and patients been taken to hospital by private transport. It is essential that these patients are transferred to definitive care (MTC) as soon as possible, improving the patient experience and outcome.
2.3 Time to secondary transfer	
Description	Time to secondary transfer to a MTC for patients who have suffered major trauma is minimised to \leq four hours from time of call to SAS to departure.
Rationale	Major trauma patients who are not taken directly to a MTC should be transferred without delay to definitive care after initial assessment and optimisation in the receiving hospital.
Paediatrics	Referral to mobilisation of transfer team is <60 minutes. Referral to team arrival with patient <3 hours (road/mainland responses). Referral to team arrival with patient <4 hours (island/air responses).
2.4.1 Time to CT head	
Description	Patients with a severe head injury have a CT scan within 60 minutes of arrival.
Rationale	Severe head injury is defined as a patient with a GCS \leq 8 and/or an AIS (head) \geq 3. All patients with a severe head injury following trauma to the head should have a CT scan as soon as possible to determine treatment required in order to ensure the best outcome.
2.4.2 Time to CT head written report	
Description	Patients with a severe head injury have a CT scan written report sent within one hour of the CT scan.
Rationale	<i>As in 2.4.1</i>
2.5 Major Trauma Centre care for patients with a severe head injury	
Description	Patients who have suffered a severe head injury are managed in a MTC.
Rationale	Severe head injury for this KPI is defined as a patient with an AIS (Head) \geq 3. Patients who have suffered severe head injury should be managed in a MTC with specialist facilities to reduce mortality and improve functional outcome.
2.6 Management of severe open long bone fractures	
Description	Patients with a severe open long bone fracture will receive IV antibiotics within three hours of first contact with emergency services.
Rationale	Evidence recommends that IV antibiotics are given to patients with severe open long bone fractures as soon as possible (ideally within three hours).
2.7 Administration of Tranexamic Acid in patients with severe haemorrhage	
Description	Trauma patients with severe haemorrhage start the administration of tranexamic acid (TXA) within three hours of first contact with emergency services.
Rationale	Trauma patients with severe haemorrhage are defined as having received at least one unit of blood products within six hours of injury for the purpose of this indicator. TXA has been shown to reduce death by bleeding if given within three hours of injury to bleeding trauma patients.
2.8 Specialist care	
Description	Patients who have suffered major trauma and are taken to a MTC, are admitted under the care of a Major Trauma Service.
Rationale	The Major Trauma Service would coordinate care from the acute phase through to rehabilitation ensuring patients receive all necessary care in a timely manner.

Ongoing hospital care: Ongoing hospital care includes rehabilitation of the patient within a hospital setting and/or within the community.

3.1.1 Assessment of rehabilitation needs	
Description	Patients admitted to a MTC have a rehabilitation plan written.
Rationale	Rehabilitation should start as soon as appropriate to enable patients to achieve their functional potential.
3.1.2 Time to assessment of rehabilitation needs	
Description	Patients admitted to a MTC have their rehabilitation plan written within three days of admission.
Rationale	As in 3.1.1
3.2 Functional outcome	
Description	Patients who have survived major trauma have their functional outcomes assessed at specified timelines.
Rationale	Trauma systems have been shown to reduce mortality and reduce disability. This will provide information on the functional outcome of patients with major trauma to ensure that the STN is effective.

KPIs for adults and paediatrics are the same except for 2.1.1 and 2.3.

Appendix two: Scottish hospitals with an Emergency Department, 2016

Health Board	Hospital (Abbreviation if used on charts in section 4)	Contributing to STAG (2016)
NHS Ayrshire and Arran	University Hospital Ayr	Y
	University Hospital Crosshouse, Kilmarnock	Y
NHS Borders	Borders General Hospital	Reviewing resource
NHS Dumfries and Galloway	Dumfries and Galloway Royal Infirmary (DGRI)	Y
	Galloway Community Hospital	After introduction of eSTAG
NHS Fife	Victoria Hospital, Kirkcaldy (VHK)	Y
NHS Forth Valley	Forth Valley Royal Hospital (FVRH)	Y
NHS Grampian	Aberdeen Royal Infirmary (ARI)	Y
	Dr Grays Hospital, Elgin	Started Jun 2017
	Royal Aberdeen Children's Hospital	Started Jun 2017
NHS Greater Glasgow & Clyde	Glasgow Royal Infirmary (GRI)	Y
	Inverclyde Royal Hospital (IRH)	Y
	Royal Alexandra Hospital, Paisley (RAH)	Y
	Royal Hospital for Children, Glasgow	Y
	Queen Elizabeth University Hospital, previously Southern General Hospital, Glasgow (SGH)	Y
NHS Highland	Belford Hospital, Fort William	Organising visit from STAG
	Caithness General Hospital	N – North of Scotland network reviewing
	Lorn and Islands District General Hospital, Oban	Reviewing resource
	Raigmore Hospital, Inverness	Y
NHS Lanarkshire	Hairmyres Hospital, East Kilbride	Y
	Monklands Hospital, Airdrie	Y
	Wishaw Hospital	Y
NHS Lothian	Royal Infirmary of Edinburgh (RIE)	Y
	St John's Hospital, Livingston	Started Mar 2017
	Royal Hospital for Sick Children, Edinburgh	Pending resource
NHS Orkney	Balfour Hospital, Kirkwall	STAG visit Oct 2017
NHS Shetland	Gilbert Bain Hospital, Lerwick	STAG visit Oct 2017
NHS Tayside	Ninewells Hospital, Dundee	Y
	Perth Royal Infirmary (PRI)	Y
NHS Western Isles	Western Isles Hospital, Stornoway	N

Note: ED Hospital data taken from [A&E datamart](#) (last updated August 17).

Acknowledgements

This report was written and produced by the report writing sub group of the STAG steering group.

Name	Role	Health Board
Ms Sarah Dickie	Head of Nursing	NHS Tayside
Mrs Hazel Dodds	Senior Nurse	Scottish Healthcare Audits, NHS National Services Scotland
Mr Malcolm WG Gordon	Chair, STAG	NHS Greater Glasgow and Clyde
Mrs Vicky Jones	Regional Coordinator	STAG, NHS National Services Scotland
Mrs Angela Khan	Clinical Coordinator	STAG, NHS National Services Scotland
Dr Crawford McGuffie	Vice Chair, STAG	NHS Ayrshire and Arran
Mrs Sinfiorosa Pizzo	Senior Information Analyst	STAG, NHS National Services Scotland
Dr Marie Spiers	Consultant in Paediatric Emergency Medicine	NHS Greater Glasgow and Clyde
Dr Julie Thomson	Consultant in Emergency Medicine	NHS Fife
Dr Ian Zealley	Consultant Radiologist	NHS Tayside

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Contact Details

For general questions about the audit please contact Angela Khan.

Angela Khan
Clinical Coordinator

NHS National Services Scotland
Information Services Division
angela.khan@nhs.net
0131 275 6895

Sinforosa Pizzo
Senior Information Analyst

NHS National Services Scotland
Information Services Division
sinforosa.pizzo@nhs.net
0141 282 2020

Mr Malcolm Gordon
Chairman

NHS Greater Glasgow and Clyde
Queen Elizabeth University Hospital, Glasgow.
malcolm.gordon@ggc.scot.nhs.uk

