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Foreword

Improving services for patients with injuries that may be life threatening or limit their functional outcome and quality of life remains a key priority for the Scottish Government.

As such, the Scottish Government has given a clear commitment to improving outcomes for trauma patients. We are making good progress with plans for the new Scottish Trauma Network (STN) - a unique model of trauma care that is suited to our geography and circumstances.

The STN will include four Major Trauma Centres in Aberdeen, Dundee, Glasgow and Edinburgh. These centres will form the hub of four regional networks which will involve close collaboration with hospitals across Scotland – all of which will have an essential role in ensuring we provide high quality trauma care quickly, and in the most appropriate setting.

People with less severe injuries will be treated locally in trauma units and local emergency hospitals, while severely injured patients will, in the vast majority of cases, be taken directly to a specialist major trauma centre. A very small number of severely injured patients, who are unable to directly access a major trauma centre quickly, will be transferred to a major trauma centre once they have been stabilised locally.

The Scottish Trauma Audit Group’s (STAG) contribution to development of the STN has been and will continue to be, fundamental. STAG’s reporting of trauma Key Performance Indicators (KPIs) will be essential in monitoring the network’s performance to help drive improvements in trauma care and ultimately patient outcomes.

The success of the STAG audit is due to the active participation, commitment and support of the clinical teams in NHS Boards across Scotland and I am pleased to see that work to improve trauma care at hospital level is included in this report. The development of eSTAG (electronic database for the collection and timely reporting of data), will in future, allow the audit to expand to all hospitals with an Emergency Department. Collecting data on the whole patient journey, including valuable information on trauma rehabilitation care, will also inform patients’ optimum recovery.

The audit continues to encourage and enable clinicians to look at how they can use data to drive improvement in services locally. I would encourage them to continue this good work, particularly once the new Scottish Trauma Network is up and running and the trauma KPIs are introduced next year. The new network and the KPIs will undoubtedly foster the sharing of best practice across Scotland and lead to improvements in trauma care across Scotland.

In the not too distant future, I very much look forward to seeing the views of patients through Patient Reported Outcomes Measures (PROMS) which will support a fully person centred approach to informing and delivering trauma service improvements.

This report reflects the good work and outcomes being achieved and I believe we will soon have the structures in place to make them better. I would therefore like to commend all those involved in the audit for their continued hard work and their important contribution to the care of injured patients.

Dr Catherine Calderwood
Chief Medical Officer
Note The Western Infirmary and Victoria Infirmary in Glasgow both closed its EDs in summer 2015.
Introduction

The 2016 STAG annual report focuses on the calendar years 2014 and 2015 and presents detailed information of the patient journeys of 6034 patients with severe injury (trauma) that have passed through the Scottish healthcare system. This can be broken down into 2745 for 2014 and 3289 patients for 2015, although data are presented for both years combined in most of the graphs. 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 to 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.

The morbidity and mortality caused by injury continues to be a major public health issue for the population of Scotland. Scotland saw a significant and rapid reduction of deaths as a consequence of an accident from the 1970s to the 1990s; however, since then accidents as a cause of death have remained fairly static. Consequently the impact of deaths and ongoing morbidity and disability following serious injury remains a great burden for the Scottish National Health Service (NHS) and the population of Scotland. In 2015 injury was the commonest cause of death for those under the age of 45 years and the third most common cause of death for those aged less than 55 years, after neoplasm and diseases of the circulatory system. Unintentional injuries accounted for approximately 1 in 8 emergency hospital admissions for children and 1 in 11 emergency admissions for adults in Scotland in the years 2014-2015.

Completion of an extensive mapping exercise has allowed us to provide comparable data from 2011 – 2015 for the first time. In 2013, STAG updated their methodology by firstly moving to the current Abbreviated Injury Scale (AIS) dictionary (2005, Update 2008) and secondly adopting the Trauma Audit and Research Network (TARN) Ps12 methodology to calculate predicted survival. This same methodology has now been applied to 2011 and 2012 data. We have also committed to continue to collect data required to calculate predicted survival using the Trauma and Injury Severity Score TRISS methodology to allow international comparisons. More detailed information on methodology can be found on pages 41-44.

There has been a great deal of progress over the last year to ensure that STAG is able to monitor key processes due to be implemented as part of the new STN and support the ongoing development of this service (see pages 32-33 for more information).

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
Summary and Main Points

STAG are able to compare data from 2011-2015 for the first time following an extensive project to map data from 2011 and 2012 to match the injury coding, inclusion methods and survival prediction methods adopted in 2013. STAG now hold a trauma database that has information on over 17000 patients treated in 2011-2015.

A total of 20 hospitals with an Emergency Department (ED) submitted data to STAG in 2014 and 2015; with the Royal Hospital for Children (Glasgow) collecting data on paediatric patients since June 2015 (see Section 6). STAG are preparing to receive data from a further 12 hospitals in the future to ensure that the care received by all patients with severe trauma is being audited (see Appendix two for more detail).

Main Points

Patients, demography and trauma type

- STAG reports on 6034 patients with severe trauma in 2014-2015.

  1313 patients were classified as sustaining major trauma (22%)

- Males made up the majority of trauma patients (59%), rising to 71% for major trauma.
- Females were most commonly injured by a low fall whereas injuries to males were due to falls and MVAs.
- 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 (25%) in 2015.

The patient journey

- In 2015, 79% of patients with minor trauma arrived by road via the Scottish Ambulance Service (SAS) rising to 85% of patients with major trauma. 9% of major trauma patients arrived by air ambulance.
- The majority of trauma patients (55%) arrived in the ED in the out of hour’s period (between 8pm and 8am or at the weekends), with 17% of patients presenting between midnight and 8am.

In 2015 25% of patients with major trauma were transferred to another hospital

Neurosurgical care is the predominant reason for these transfers in 2014-2015
Patients who survive to hospital discharge or for more than 30 days with major trauma have a median length of stay (LOS) of 17 days compared with nine and seven days for patients with moderate and minor trauma.

Of the patients who die following trauma, LOS is shorter for the more severely injured patients. This may be influenced by co-morbidity.

**Quality Indicators 2015**

**Patients with major trauma** 71% were pre-alerted to the receiving hospital and 67% were seen by an Emergency Medicine Consultant within one hour.

**Patients with a severe head injury** 35% had a CT scan within one hour and a further 33% had a CT scan within two hours.

34% of patients were transferred to a hospital site with Neuroscience Intensive Care Unit facilities.

**Patients with an open long bone fracture** 86% of patients received intravenous antibiotics within three hours.

Although there is still improvement work required, it should be noted that there has been a rise of 10-11% compliance in three of these measures from 2013 to 2015.

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.

**Patient outcome**

- The overall mortality rate for all patients was 6%. The mortality for patients with major trauma is 22%.
- This year, the mortality rate within all of the hospitals contributing to STAG was within 3 standard deviations meaning that no hospital had significantly different mortality rates.
## Section 1: Data completeness

### Figure 1.1 Data completeness by hospital (2014)

**Key:**  
- Data submitted  
- No data submitted  
- Partial data submitted  

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* Southern General Hospital was renamed Queen Elizabeth University Hospital in July 2015.

**Note:** In 2014 11 audit patients attended two STAG EDs during a single episode of care. Only the first STAG ED attendance has been analysed in this report. A further two patients were removed from this analysis because there was not enough information available to code the trauma injury (N= 2745).
**Figure 1.2 Data completeness by hospital (2015)**

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<td>8</td>
<td>9</td>
<td>125</td>
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<td>23</td>
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<td>42</td>
<td>26</td>
<td>24</td>
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</tr>
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<td>45</td>
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<td>Raigmore Hospital, Inverness</td>
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<td>185</td>
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<td>19</td>
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<tr>
<td>Royal Infirmary, Edinburgh **</td>
<td>26</td>
<td>22</td>
<td>26</td>
<td>25</td>
<td>22</td>
<td>25</td>
<td>(+38) (+35) (+32) (+32)</td>
<td>21</td>
<td>193 (+137)</td>
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<td>Victoria Hospital, Kirkcaldy</td>
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<td>8</td>
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<td>46</td>
</tr>
<tr>
<td>Western Infirmary, Glasgow***</td>
<td>27</td>
<td>11</td>
<td>22</td>
<td>16</td>
<td>19</td>
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<td></td>
<td>95</td>
</tr>
<tr>
<td>Wishaw General Hospital</td>
<td>13</td>
<td>10</td>
<td>11</td>
<td>10</td>
<td>9</td>
<td>9</td>
<td>11</td>
<td>9</td>
<td>11</td>
<td>7</td>
<td>9</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td>Patients Included</td>
<td>299 (+16)</td>
<td>231 (+10)</td>
<td>287 (+15)</td>
<td>260 (+10)</td>
<td>294 (+12)</td>
<td>290 (+10)</td>
<td>272 (+11)</td>
<td>278 (+55)</td>
<td>273 (+39)</td>
<td>248 (+39)</td>
<td>258 (+38)</td>
<td>303 (+5)</td>
<td>3293 (+260)</td>
</tr>
</tbody>
</table>

** Due to resource issues not all eligible patients have had a proforma submitted. Patient numbers not included in this report are found in the brackets.

*** Victoria Infirmary and Western Infirmary, in Glasgow, closed their EDs in summer 2015.

Note: In 2015 4 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= 3289).
In 2014 and 2015, 20 hospitals submitted data to STAG. Data on 19 of these hospitals are included in the main report and a summary of paediatric data collection at the Royal Hospital for Children (Glasgow) can be found in Section 6. A total of 2745 patients were included in the audit in 2014 and 3289 in 2015. Local staffing issues in some hospitals meant that information was not available for the full years, and this was more pronounced in 2014 (Figure 1.1). 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. A new Memorandum of Understanding document between National Services Scotland and NHS Boards (on behalf of all the Scottish Healthcare Audits) has been finalised and is due to be sent to NHS Boards. Part of this document includes improving resilience to prevent data gaps in the future. In 2015, two hospitals were unable to supply data for the whole year but were able to determine the number of patients that would have been included in the audit which amounted to a further 260 patients.

During 2015, there were major changes to emergency care in NHS Greater Glasgow and Clyde with the Western Infirmary and Victoria Infirmary closing their EDs and the Southern General Hospital being renamed the Queen Elizabeth University Hospital (QEUH), following the opening of a new hospital that was built on the same site. The number of patients included in STAG reflects these changes with increases seen in both the QEUH and Glasgow Royal Infirmary (Figure 1.2).

STAG data collection must be seen 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

STAG are now able to compare data from 2011-2015 due to an extensive mapping exercise carried out in 2015 that applied the same clinical coding and inclusion criteria to 2011-2012 data that was adopted by STAG in 2013. More information on the this work can be found in the methodology section on page 44.

Figure 2.1 shows the number of patients included in STAG from 2011-2015 and the severity of trauma based on the Injury Severity Score® (ISS).

![Percentage of patients by severity of trauma (2011-2015)](image)

The year on year comparisons of the proportion of patients suffering minor, moderate and major trauma are broadly comparable and likely to represent normal variation.
The excess of male patients suffering major trauma is a pattern that is previously established and remains relevant for injury prevention strategies.

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

There continues to be year on year variation of the percentage of patients who have suffered penetrating trauma.
Figure 2.4  Percentage of male and female patients by mechanism and severity of injury (2014-2015)

MVA: Moving vehicle accident (refers to any motor vehicular accident 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.

The predominance of females with minor and moderate trauma following a low fall and males with major trauma following MVAs and falls is previously observed.
Figure 2.5  Percentage of male and female patients where there was evidence of involvement of alcohol, by severity of trauma (2011-2015)

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.

The association of alcohol involvement with all severities of trauma is consistent over the last five 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 (2011-2015)

The proportions of patients experiencing varying levels of trauma and their conveyance to hospital has remained relatively constant over the last five years. The involvement of ambulance and air conveyance could facilitate the changes in patient journeys associated with the development of new trauma networks through involvement of the Scottish Ambulance Service (SAS) in the initial phases of new patient pathways for seriously injured patients.

Figure 3.2 Percentage of patients by day and time of attendance (2014-2015)

Note: ‘Out of hour’ attendances are those that took place at the weekend or between the hours of 8:00pm and 7:59am.
The number of trauma patients attending ED is stable from Monday to Thursday and then increases from Friday to Sunday.

55% 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).

The pattern of trauma presentations should continue to be considered to inform future workforce planning and rota management for EDs and the relevant in-patient specialties.

**Figure 3.3  Percentage of patients transferred to another STAG hospital or regional centre, by severity of trauma (2011-2015)**

<table>
<thead>
<tr>
<th>Severity of trauma</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
<td>150</td>
<td>253</td>
<td>32</td>
<td>145</td>
<td>201</td>
</tr>
<tr>
<td>Moderate</td>
<td>184</td>
<td>230</td>
<td>1725</td>
<td>1751</td>
<td>1728</td>
</tr>
<tr>
<td>Major</td>
<td>599</td>
<td>595</td>
<td>585</td>
<td>585</td>
<td>748</td>
</tr>
</tbody>
</table>

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

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

25% of patients with major trauma were transferred to another hospital from the ED or hospital of initial attendance in 2015, highlighting the complex journey many severely injured patients have. This is a reduction from previous years that may be explained by the reduction of EDs in Glasgow. In addition, 8% of minor and 5% of moderate trauma patients were transferred in 2015 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. Any change to Scottish healthcare trauma provision should seek 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 (2014-2015)

Note: 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 (new electronic data collection system).

The dominant reason for patient transfer for more seriously injured patients is for neurosurgery. This has been a consistent finding in previous years. These transfers can be time-critical. Changes to trauma care provision at a systems level need to be sensitive to this.
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) 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 (late transfer) by severity of trauma (2011-2015)**

<table>
<thead>
<tr>
<th>Year of Attendance</th>
<th>≤ 1 day</th>
<th>2 - 7 days</th>
<th>8 - 14 days</th>
<th>15 - 29 days</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>8</td>
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<td>28</td>
</tr>
<tr>
<td>2012</td>
<td>7</td>
<td>12</td>
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<td>0</td>
<td>19</td>
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<td>2013</td>
<td>7</td>
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<td>5</td>
<td>2</td>
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<td>2015</td>
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<tr>
<td>Major</td>
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<td>2015</td>
<td>45</td>
<td>35</td>
<td>6</td>
<td>7</td>
<td>93</td>
</tr>
</tbody>
</table>

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

The proportion of early transfers for moderate and major trauma remain consistent. Proportions of later transfers are affected by small numbers.
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 (2014-2015)

![Graph showing percentage of patients by severity of trauma and length of stay.]

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

Intuitively, more severely injured patients who survive have a longer LOS.

It is important to note that this does not reflect true LOS as STAG only follow up patients until a maximum of 30 days and are only able to follow patients through to discharge from hospitals contributing to STAG or who are transferred to the Golden Jubilee National Hospital cardiothoracic units or the Western General Hospital neurosurgical units.

These data serve 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 (2014-2015)*

![Graph showing percentage of patients by severity of trauma and length of stay.]

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

* In 2015 STAG started collecting data on deaths that occurred in less than 15 minutes from arrival to ED. To make inclusion/exclusion criteria consistent for 2014-2015 datasets, deaths in ≤15 minutes have been excluded from this graph, one moderate and 18 major trauma patients, specifically.
Of the patients who die following trauma, LOS is shorter for the more severely injured patients. This may be influenced by co-morbidity. 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.

29% 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 healthcare was set out in the Healthcare Quality Strategy for NHS Scotland® which was endorsed by the Scottish Parliament and published in May 2010.

The Quality Strategy sets out three clearly articulated and widely accepted Quality Ambitions for safe, effective & person centred care. It aims to deliver the highest quality healthcare to the people of Scotland and to ensure that NHS Scotland, integrated Joint boards and the third sector are working together with patients, carers and the public towards a shared goal of world leading healthcare.

The Quality Measurement Framework¹⁰ provides a structure for aligning the wide range of measurement that are used throughout NHS Scotland and how this helps to drive progress towards our quality ambitions.

The three levels described by the framework are:

1. Quality Outcomes
2. Quality Outcome Indicators
3. HEAT Targets - for priority improvements towards the Quality Outcomes and Ambitions

All other local and national measurement for quality improvement and performance management


Quality improvement within STAG draws on a wide variety of methodologies, approaches and tools. Gathering data and measurement against standards are vital elements of quality improvement in addition to the learning, which develops through the process over time. STAG currently report compliance (Level 3) with 15 QIs and have agreed on 16 KPIs essential for monitoring the STN and supporting its ongoing development and improvement. Level 1 Quality Outcome Indicators include PROMs and STAG are working towards the introduction of these in 2017.
Clinical audit is one tool for finding out how well care is being provided and learning if care can be improved, the clinical audit process:

- Shows if care provided is routinely consistent with evidence
- Helps a clinical team to find where improvements in practice are needed
- Raises awareness of the information that has to be documented
- Facilitates learning about current practice among members of the clinical team and working together to make improvements.

STAG Clinical Leads, LACs and the clinical teams play a vital role in achieving this.

Compliance with Quality Indicators

This is the second 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 on page 48.

Figure 4.1 Percentage of major trauma patients who were pre-alerted, by hospital (2014 and 2015)

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 journey. A pre-alert to the receiving hospital in Scotland from 2014 to 2015 however there is wide variation between hospitals with a range of 33-90% in 2015.

The introduction of the SAS Trauma Triage Tool in 2017 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.
Figure 4.2  Percentage of major trauma patients who were seen by an Emergency Medicine Consultant within one hour, by hospital (2014 and 2015)

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 number of major trauma patients being seen by an EM consultant within one hour has risen from 62% in 2014 to 67% in 2015 and again there is wide variation between hospitals (38-91%).

Figure 4.3.1  Percentage of patients with a GCS ≤ 8 and/or severe head injury that had a head CT scan within one hour, by hospital (2014 and 2015)

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) head ≥ 3.

Figure 4.3.1 shows compliance with one of the new KPIs that will be adopted in 2017.
Compliance with the one hour target remains low (Figure 4.3.1) at 35% in 2015, however figure 4.3.2 shows that the majority (68%) of patients with a severe head injury in 2015 received a CT scan within two hours of presentation. Many hospitals are trying to address the timeliness of these scans (see pages 20-27 for more details).

**Figure 4.4.1** Percentage of patients with a severe head injury who were transferred to a setting with 24 hour access to a Neurosurgical ICU, by hospital (2014 and 2015)

Note Severe head injury is defined as a patient with an AIS (head) $\geq 3$. 
Three hospitals have 100% compliance with this QI because they have an onsite neurological Intensive Care Unit (ICU) facility 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 this graph. 34% of patients with a severe head injury were transferred to a setting with 24 hour access to a Neurosurgical ICU.

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

STAG will improve how these data are collected in the new data set that will be launched in early 2017 with the introduction of an electronic data collection tool - eSTAG.

Figure 4.4.2    Percentage of patients with a severe head injury who had a neurological specialist referral whilst in the ED, by hospital (2014 and 2015)

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 AIS\(^4\) head ≥ 3. 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 4.4.2 shows that 76% of patients with a severe head injury had a neurological specialist referral while they were in the ED.
Figure 4.5  Percentage of patients with an open limb fracture who received intra venous (IV) antibiotics within three hours, by hospital (2014 and 2015)

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

Scottish compliance has fallen slightly from 88% in 2014 to 86% in 2015.

Figure 4.6  Summary of Scottish compliance with Indicators (2013-2015)

Although there is still improvement work required, it should be noted that there has been a rise of 10-11% compliance in three of these measures from 2013 to 2015.

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 Clinical Lead 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 Ayrshire and Arran

University Hospital Ayr (Dr Teresa Hand)

We review the data locally at departmental meetings and try to make service improvements if a specific area is highlighted. Eg document senior involvement, get gases where relevant, antibiotics for compound fractures.

Our radiology position has not changed so no improvements have been made.

We feed back highlighted cases to specific specialities.

University Hospital Crosshouse (Dr Crawford McGuffie)

The Clinical Lead (CL) and LAC meet monthly and review all major trauma patients whose audit cycle has been completed, as well as all moderate trauma patients whose audit cycle has been completed and who have not met any of the QI standards during their patient journey.

In addition, all trauma patients who have died and were categorised by statistical modelling as expected to survive are reviewed.

All major trauma patients are presented by the LAC and CL at the ED multi disciplinary team educational meeting every month.

All QI standards that are not met for these major trauma patients are reviewed both individually and on a themed basis and all moderate trauma patients where specific QI standards are not met are also presented at the same meeting.

All trauma patients who have died and were categorised by statistical modelling as expected to survive are reviewed at this meeting.

Progress updates on themes that have previously been identified, are received at this meeting. Examples include time to CT scanning out of hours, SAS stand by rates for trauma patients and the management of penetrating torso trauma.

The LAC and the CL review the monthly QI report to assess progress.

These reports are shared with the Orthopaedic Department, General Surgical Department and the Critical Care Department.

Local information has been used to inform discussions within the NHS Ayrshire and Arran Major Trauma Working Group as well as the West of Scotland Major Trauma Group.

Governance is discharged via the EM Clinical Governance Committee to the Acute Services Clinical Governance Steering Group.

There has been significant improvement in the use of the data within Crosshouse Hospital over the last 12 months and a significant proportion of the credit for this improvement rests with the hard work and commitment of the clinical teams in general and the LAC, Elma Norwood, specifically.
Scottish Trauma Audit Group Annual Report 2016

NHS Fife

Victoria Hospital, Kirkcaldy (Dr Julie Thomson)

Over the past year we have reviewed each STAG patient entered into the database each month with the LAC. Since January, using these data, feedback has been given individually to each medical staff member involved in the care of any STAG patient with moderate or major trauma highlighting key areas, quality indicator compliance and evidence of good practice. Monthly reports on performance in trauma are highlighted in teaching areas and again distributed within the department to continue to raise the awareness of STAG and the QIs.

In August 2016, as a result of last year’s STAG report we have re-instigated trauma teams within the Victoria Hospital. We have developed strict criteria for callout of the team and also ED consultant staff, when out of hours. Trauma team paperwork has been introduced for these call outs which should improve and standardise care, whilst enabling easier collection of data. Each case of trauma team activation will be audited and reviewed within the interdisciplinary meetings for trauma, with a focus on presence of key team members on arrival of patient and early investigations. These meetings will hopefully allow us to develop a number of new pathways to improve trauma care for our patients.

We have worked closely with SAS staff locally to improve the information given from the pre-hospital setting and also improve the handover process within the department. Trauma cases are fed back to ambulance staff, again emphasising QIs with aim of improving awareness of mechanisms for trauma and prehospital care eg pelvic splint application.

NHS Grampian

Aberdeen Royal Infirmary (Dr Angus Cooper)

Over the past few years STAG data in Aberdeen has been incomplete and this was identified as a priority to improve. A new LAC has now been appointed after a successful business case, increasing the Whole Time Equivalent from 0.5 to 1.

STAG data have been used:

- By the Public Health consultant in her contribution to planning of the Major Trauma Centre and Trauma Network.
- Departmental Clinical Governance meetings (review of all deaths plus other groups e.g. patients who have not met the standard for CT head in one hour, patients with major trauma whose admission is not a critical location and was this an appropriate care location. This will contribute to planning of Major Trauma ward (part of our implementation plan).
- Small contributions to multi-disciplinary, multi-specialty monthly Trauma Education Sessions so far – anticipate that this will increase and that, after the introduction of eSTAG with real time data, we will be given a dedicated slot to present STAG data.
- STAG data set has contributed to Trauma Documentation - new document being piloted in October.
- About to compare STAG major trauma patients with our data set of trauma calls in order to identify our over and under triage rates.
NHS Greater Glasgow and Clyde

Glasgow Royal Infirmary (Dr Neil Dignon)

Glasgow Royal Infirmary continues to hold monthly multidisciplinary Trauma Group meetings to review all cases of Major Trauma and discuss relevant matters.

The group enjoys considerable support amongst the ITU, Anaesthetic and Surgical teams and more recently Radiology and Haematology teams.

We have refined our pan CT scanning processes for major trauma.

We have had to initiate Major Incident procedures for trauma on two occasions since the last report.

We continue to refine our Major Trauma documentation and processes.

We are currently introducing ‘in resus sim’ to improve team working and processes.

Queen Elizabeth University Hospital, Glasgow (Dr Hannah Smith)

Activity

The proportion of ED patients eligible for the audit at the QEUH is 0.5% which compares with 0.3% for the rest of Scotland for both 2014 and 2015. This is partly driven by a higher than average number of patients transferred into the QEUH. The proportion of patients transferred into the QEUH from another receiving hospital is 5% which compares with 3% for 2015 and 2% for 2014 for the rest of Scotland. For June 2015 to December 2015 this is a total of 14 patients.

The eligible patients are grouped into three bands of severity of injury (trauma). These are shown on the table below along with the equivalent data for Scotland.

<table>
<thead>
<tr>
<th>Severity of Trauma</th>
<th>QEUH 2015</th>
<th>Scotland 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor (ISS &lt;9)</td>
<td>59 (23%)</td>
<td>790 (24%)</td>
</tr>
<tr>
<td>Moderate (ISS 9-15)</td>
<td>123 (47%)</td>
<td>1751 (53%)</td>
</tr>
<tr>
<td>Major (ISS &gt;15)</td>
<td>77 (30%)</td>
<td>747 (23%)</td>
</tr>
</tbody>
</table>

The table above shows that the QEUH seen a higher proportion of major trauma than the average for the rest of Scotland in 2015.

Bi-monthly trauma meetings

We now have an established bi-monthly trauma meeting which is multi-disciplinary and focuses on particularly interesting or complex cases that have been included in the STAG audit.

We endeavour to have a rotating theme at these meetings in order to cover multiple aspects of trauma care.

As well as in-patient specialties, we also involve the Emergency Medicine Retrieval Service, Fire Service, and District General Hospitals that transfer patients to our unit.

Audit

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

Time to CT Head in the ED - We have looked at this issue and factors which have contributed to the delay. There is ongoing discussion between radiology and the ED regarding how this can be streamlined further.
Blood Transfusion and temperature control in Major Trauma - Over 90% of major trauma patients requiring blood transfusion have a temperature <36 degrees on arrival to the ED. The re-warming process is going to be standardised. Our resuscitation room was not built with a thermostat. Estates now have guidance to attempt to maintain the temperature at 23.5 degrees.

Chest Drain Audit - Ongoing audit into insertion of chest drains in the ED, trauma patients making up large proportion of this cohort.

Head Injury Admission Audit - Head injured patients who are not being admitted under neurosurgery are admitted under the ED. The care of these patients is being audited under the ongoing Head Injury admission audit.

National Code Red Audit - There has been a national review of “Code Red” patients, the majority of whom are incorporated into STAG. As a consequence, pre-thawed Fresh Frozen Plasma is likely to become available within the QEUH.

Research
There is an ongoing project assessing access to neurosurgical care (Scotland-wide) for serious head injury patients.

There is an ongoing general surgical study to review the outcomes related to emergency surgery.

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.

If there are recurrent issues highlighted these are communicated to the department via the Consultant meeting, email and departmental weekly brief. An example of this was poor documentation of Consultant presence in spite of the department having a Consultant presence 16 hours per day.

Trauma teaching is included in the registrar’s weekly training and particular issues will be highlighted. At West of Scotland Regional teaching there is also a STAG-related component.

Process
Trauma booklet - There is ongoing work being undertaken to standardise documentation in trauma with the creation of a trauma booklet.

CT & Radiology - There is ongoing discussion with radiology to streamline the process of whole-body CT in order to reduced time spent waiting for and in CT.

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; and
- use of standardised patient packaging including radiolucent scoop stretcher to reduce time to CT.
NHS Highland

Raigmore Hospital, Inverness (Dr Kirsteen Wintour)

Since taking up the post of STAG Clinical Lead in Raigmore in June 2016, I have arranged to meet with our local coordinator on a monthly basis to review the STAG data. This enables us to ascertain any discrepancies timeously, and to identify which of the QIs we could better meet. Continuing to raise the profile of trauma (and STAG) in our department and beyond will facilitate improved trauma care.

We held a local European Trauma Course in May 2016, organized by one of our anaesthetists. With three of the Raigmore ED candidates nominated as instructors, there is an enthusiasm to not only continue local delivery, but also to develop local faculty for the course.

Following the course, one of the Emergency Medicine (EM) Consultants has drafted a hospital major trauma chart. This is currently being redrafted following a trial period. Once in use it will be a valuable tool to improve and standardise patient care, in addition to facilitating data collection. There is also an aspiration, within the ED and beyond, to develop a functioning hospital trauma team. We are in the process of ascertaining suitable call out criteria for both an ED trauma team and a hospital wide trauma team.

Raigmore ED hosts a regular Critical Care Group meeting, extending an open invitation to all specialties to discuss cases of concern. This includes, but is not exclusive to, trauma deaths. This opportunity was created with an aim to simultaneously improve trauma handling and engagement with different specialties. We have consistent anaesthetic attendance, and occasionally general surgical input.

Regarding specific QIs:

There has been an expansion in EM Consultant numbers in the last 18 months to five whole time equivalents. This has enabled longer periods of Consultant shop floor cover, and increased likelihood of patients with major trauma being seen by an EM Consultant within one hour of arrival.

We have agreement from radiology to use X-ray compatible scoop stretchers, therefore minimizing unnecessary patient movement and subsequently speeding up time to get in and out of the CT scanner. We are currently going through the procurement process to obtain the scoops.

On the prehospital handling of trauma front Raigmore/NHS Highland have invested in a program for improvement of quantity and quality of enhanced care provision. An expanded team of British Association of Immediate Care (BASICS) responders are being provided with standardised equipment, training, pharmacy, decision support, standard operating procedures and case review. These are being implemented in line with the recommendations of national guidance on prehospital care and in agreement with other regional providers.

Case review and feedback is also being done for Search And Rescue (SAR) cases brought to Raigmore by the local SAR team. As a hospital we have hosted paramedics and winch men for clinical placements to promote shared standards and understanding of trauma/medical care.

We are also participating in the major trauma planning processes at board and ‘North of Scotland’ level as the major trauma network(s) are moved forwards.
NHS Lanarkshire

Monklands Hospital, Airdrie (Dr Barbara Key)

In last year’s STAG Annual Report, Monklands Hospital fell out with 3 Standard Deviations (SD) with the quality indicator:

I. Patients with a GCS ≤ 12 and/or a base of or depressed skull fracture who had a CT scan within one hour

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scotland</td>
<td>186 (44%)</td>
<td>143 (38%)</td>
</tr>
<tr>
<td>Monklands</td>
<td>3 (30%)</td>
<td>4 (40%)</td>
</tr>
</tbody>
</table>

Although our figures are similar to the Scottish average, the results are still poor. Also included in the report, were the results for each hospital as measured against the Key Performance Indicators (KPIs) that will be introduced with the STN:

II. Patients with a severe head injury and/or GCS ≤ 8 who had a CT scan within one hour

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scotland</td>
<td>218 (36%)</td>
<td>176 (34%)</td>
</tr>
<tr>
<td>Monklands</td>
<td>4 (20%)</td>
<td>6 (27%)</td>
</tr>
</tbody>
</table>

We organised a process mapping exercise to look at this issue. Both the LAC and Clinical Lead for STAG were involved, along with the service manager for quality improvement, a consultant radiologist and the lead CT Radiographer.

A patient who had been brought in by ambulance as a standby (pre-alerted by the SAS) was used for the mapping exercise. The patient had fallen downstairs and had a GCS of 8 on arrival. The patient journey was mapped from arrival at the ED to the end of the CT scan. The radiology journey continued until the ED consultant had the CT Report results.

The mapping exercise showed that at worst, the entire journey from arrival to CT report took 1h 25mins during the out of hours period, and took approximately the same length of time in hours providing the CT scanner did not need deep cleaned or have a patient undergoing a biopsy on the table when the request was made. There were no delays identified that could easily be resolved without a second CT scanner in the hospital. We recognised that the process can be faster than that mapped but the delays are clinical in nature depending on the treatment required to ensure a safe transfer.

Whilst a patient with an isolated head injury was used as an example, the times for a full body CT scan were included in the map, and the same issues identified.

There were a few action points identified and these have been cascaded or completed:

- Ensure that all times are recorded accurately on TRAKcare for standbys – triage time needs to be set to the time of arrival, and doctors need to enter their attendance time as the arrival time as well.
- Ensure that all clocks on the three electronic systems are showing the same time.
- Ensure that all emergency requests are put through TRAK as “Emergency”.
Wishaw General Hospital (Dr Valerie Maclean)
Performance against QIs continues to be reviewed on a regular basis. Steps to improve quality over the past year include:

- Introduction of a trauma sheet to make recording of information easier
- Development of local guidelines on trauma management including who to call and what to do in the interim (developed by a multidisciplinary group)
- Review of the resuscitation room layout after visits to other units and adopting best practice

NHS Lothian

Royal Infirmary of Edinburgh (Dr Dean Kerslake)
Over the last year we have started a number of initiatives to improve quality of trauma care. We have monthly interdisciplinary governance meetings based upon STAG data to identify cases we can learn from. Through these meetings we have developed a number of new processes. We are working closely with the Scottish Ambulance service (SAS) on our pre-alert information and handover structure to refine our Emergency Department response. We have also undertaken joint training days with the SAS on packaging and traumatic cardiac arrest. We continue to use mandatory trauma consultant criteria to aim for a consultant presence for all major trauma patients and are developing trauma team leader training programmes locally. We have point of care haemostasis measuring along with earlier availability of blood products and prothrombin concentrates for patients in haemorrhagic shock. Our anaesthetic and surgical colleagues have also been reviewing their process around damage control procedures. We are developing imaging guidelines to improve our times to CT for major trauma patients. Our STAG data has been crucial for identifying cases that may benefit from multidisciplinary review and drive quality improvement initiatives.

NHS Tayside

Ninewells Hospital, Dundee and Perth Royal Infirmary (Dr Michael Johnston)
Following review of data contained within the STAG Annual report 2015, in particular the data relating to ‘time to CT Head ’ (patients GCS ≤ 12 and/or a base of Skull fracture), we were keen to explore these cases in more detail as only 25% of our patients within this category were being scanned within one hour. Our LAC prepared further breakdown of this patient group to include the following: further breakdown of overall time to CT, time to CT ‘in-hours and ‘out-of-hours’; mechanism of injury and time to head CT, mean and median ISS and time to head CT, and characteristics of patients who had a CT head after admission to the ED Observation Unit.

It is important to highlight that Ninewells Hospital in Dundee is one of only three hospitals in Scotland where Neurosurgical services exist ‘on-site’. We currently do not look to scan patients presenting in the out-of-hours period who have either suspected depressed skull # or base of skull # within one hour unless the GCS is <15. It is our local protocol to admit such patients to our Observation Unit and obtain a CT scan within normal working hours.

It was noted that 25% of all patients were scanned within one hour and a further 26% were scanned within 90 minutes, however focussing on the out-of-hours period we found that only 20% of cases were scanned within one hour compared with 40% in-hours. Currently Ninewells do not have 24 hour CT Radiographer presence and therefore these staff require to be called in from home in the out-of-hours period. Whilst this may contribute to delay there may be other factors
involved that could lead to delay at these times. The outcome from this is that we would now look to mobilise the on-call CT radiographer on receipt of a trauma pre-alert from the SAS.

15.5% of patients meeting the criteria for CT head scan within one hour were admitted initially to the Observation Unit. Mean GCS for these patients was 14 (range 9-15), only two with GCS <13 (9 and 11) both had documented alcohol intoxication. 13 of these cases arrived in the out-of-hours period. 7 cases had ISS 9-15 and 8 had ISS of >15. All were subsequently admitted care of the Neurosurgical team. Only one patient from this group required surgical intervention and this was performed at four days post admission to the Neurosurgical unit. Further review of this patient group is underway.
Section 5: Outcome

The Revised W-Statistic shows the number of actual survivors compared with the number of expected survivors which allows a better comparison of mortality over time and between different hospitals, as trauma severity and hospital case-mix are adjusted for. In 2013, STAG changed the methodology for calculating expected survival rates from TRISS\(^6\) to TARN Ps 12\(^5\) method. STAG also started to use an updated dictionary (AIS 2005; Update 2008)\(^4\) for coding injuries in order to calculate an ISS\(^8\), which is part of the Ps 12 calculation\(^5\). Work to map 2011 and 2012 data has now been completed allowing comparison of these data from 2011-2015.

Figure 5.1 Revised W-Statistic: by hospital (2014 – 2015)

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 are presenting the Revised W-statistic in a funnel plot again this year. Please see page 43 for more information on funnel plots.

Hospitals outside 2 Standard Deviations (SD) from the mean “might be different” and outside 3 SD “are different”. It should be recognised that in a comparison of 19 hospitals there is a considerable chance of an outlier at the 2 SD (5%).

Being an outlier may be explained by data quality, questions over standards of care, different referral patterns, admission policies or resources but it also may be due to random variation.

Figure 5.1 shows the Revised W-statistic for all adult hospitals who have contributed to STAG during 2014 and 2015 (N = 19).

Please note that four 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 42) for more detail on analysis.
In the 2015 report we analysed the W-Statistic for the years 2013 – 2014 and Inverclyde Royal Hospital (IRH) were more than 3 SD from the mean. This triggered a new governance process within STAG to work with IRH to investigate this further. This process was new to both STAG and IRH Clinicians. A summary of the experience by IRH staff is presented here.
Confessions of an ‘Outlier’ (Dr Niall McMahon, Inverclyde Royal Hospital)

When you find out “your” hospital’s dot is going to be an outlier on the trauma mortality graph within the STAG national report it is, let’s face it, not the best day of your working life. However it was not a surprise! We had known our absolute death rate was higher for some time but with such small numbers of patients there was never anything statistically significant and drawing conclusions had been extremely hazardous as a result. In combining two years data STAG had provided useful and valid results but at the same time left us with more questions rather than fewer. The release of embargoed or provisional results ensured we were well aware of the problem in advance and actually able to investigate in detail and have some action plans in place by the time any media spotlight or external scrutiny was upon us.

Whilst the knee jerk question might be “why?” the first constructive question was “really?” Were we sure the data was accurate? The detailed and organised log of submitted audit data held by our local coordinator allowed us to very quickly check numbers, outcomes etc. Also, STAG concurrently re ran our data to quality control their statistical analysis. Very quickly we were able to be confident in the data and begin looking at whether it was our patients or our system producing these results. In particular, were there recurrent themes or problems we had thus far been unaware of?

Unsurprisingly, news of outlier status generated a much wider and higher level interest within the hospital than other trauma statistics. Clinical experience and access to historical data had us confidently explaining there was no single factor or quick fix but that (using a GB cycling analogy) it was down to the one percents and ‘marginal gains’.

As a result, we carried out a multi disciplinary, retrospective case review. This was made easier by having some of the data already to hand and a relatively small number of cases to review but we still had trolleys piled high with case notes to go through. The electronic future may indeed be bright! Only by looking through each case from beginning to end could we pick out the subtle issues and learning points but also reassure everyone there were no glaring errors in our system of care.

Inevitably we were able to collate a number of learning points which led to recommendations for change. Some simple, such as engaging with local SAS crews to discuss pre alerts, some more complex such as service changes within hospital services not solely dedicated to trauma care e.g. geriatric / rehab medicine. Importantly we shared our results – throughout the hospital and board but also wider. This was done in a spirit of openness but most importantly to maximize the learning that came about as a result of our work.

What started out as a potentially negative investigation actually became a positive collaboration which will benefit trauma patients and their care within our hospital now and in the future.
Section 6: Paediatric STAG data collection

As a result of the pilot of paediatric data collection at the Royal Hospital for Children Glasgow (RHC) we have twelve months worth of data. This has allowed us to address and make changes to the proposed paediatric data set and evaluate the inclusion criteria and KPIs for this particular patient group. Work to establish validations for submitted paediatric data has been delayed due to other priorities faced by STAG.

In the twelve months from June 2015 to June 2016 RHC had a total of 83 cases that met the current inclusion criteria into the audit. This amounts to 0.1% of our annual attendance of 59483 children and young people. Of these 20 (24%) cases were major trauma with an ISS range of 16 to 51; 52 (63%) cases were moderate with an ISS range 9-14 and the remainder were minor with an ISS range 4-5. We found a higher preponderance of boys were entered into the audit with an almost 3:1 male: female ratio.

With regard to age groups the breakdown was as follows:

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>% of admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>24</td>
</tr>
<tr>
<td>3-6</td>
<td>18</td>
</tr>
<tr>
<td>7-9</td>
<td>17</td>
</tr>
<tr>
<td>10-12</td>
<td>28</td>
</tr>
<tr>
<td>13-16</td>
<td>13</td>
</tr>
</tbody>
</table>

The most common mechanism of injury was road traffic collisions (35%) with falls being a close second (33%). Two thirds of patients presented directly to the RHC Emergency with the remainder being direct transfers in from other departments or retrieval cases. Of all cases entered into the audit 64 (77%) arrived via Scottish Ambulance Service, either by road or air, meaning the remainder self presented to the ED and were therefore unheralded.

There were no fatalities at the time of removal from the audit over this twelve month period.

Separate work is currently ongoing looking at trauma documentation at RHC with a view to aiding data collection for the audit. A project to review under one year olds who are excluded from the audit because their length of stay is less than three days is under way for this twelve month period which will enable the steering group to consider whether the current inclusion criteria are fit for purpose for this age group given the injury patterns, aetiology and early discharge more common in this population.

This preparatory pilot work has been essential to the development of paediatric STAG and will continue ahead of the planned general roll out of paediatric data collection next year.
The Future of major trauma care in Scotland

Scottish Trauma Network

In 2013 a report produced by the Major Trauma Subgroup of the National Planning Forum (NPF) at the Scottish Government\textsuperscript{12}, outlined possible ways to enhance existing services for patients suffering major trauma in Scotland. Patients who sustain major trauma have a better outcome if they are quickly taken to a hospital where all the specialist services they will require are available, often referred to as definitive care. One of the significant changes in Scotland will be the introduction of Major Trauma Centres (MTCs), where patients with suspected major trauma will be taken either directly or after initial assessment and treatment in a Trauma Unit (TU) or Local Emergency Hospital (LEH). The Scottish Government news release in June 2016\textsuperscript{13} confirmed that there will be four MTCs in Aberdeen, Dundee, Edinburgh and Glasgow. Work to achieve this objective is underway with the Chief Medical Officer, Dr Catherine Calderwood chairing the Implementation Group. The system will rely on the right patients being taken to the right facility and the SAS, MTCs, TUs and LEHs will play a key role in the whole service being effective for all trauma patients.

Key recommendations for STAG

The NPF made a series of recommendations for the future of trauma data collection provided by STAG in view of establishing a major trauma service:

1. Mandatory participation

At the time of writing this report (August 2016) there are 30 hospitals with an ED in Scotland and 18 of these hospitals already contribute data to STAG. STAG are currently reviewing expected numbers of patients that would attend the 12 non-contributing hospitals by using the International statistical Classification of Diseases and related health problems (ICD-10)\textsuperscript{14} trauma codes and data from the Scottish Morbidity Record (SMR01) dataset in ISD\textsuperscript{15}. This will allow us to plan the resources required to collect STAG data in these hospitals. See Appendix two on page 48 for a list of all the hospitals with an ED.

2. Include paediatric patients with trauma

The NPF has 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).

See section 6 for more details on progress with this.

3. Key Performance Indicators (KPIs)

The KPI Subgroup of the STAG Steering Group first met in September 2014. The indicators have been selected following a long consultation process and literature reviews for supportive evidence and were agreed by the Major Trauma Oversight Group in May 2015. See Appendix one (page 45) for the full list of indicators.
4. Rehabilitation

STAG are working closely with rehabilitation colleagues to ensure data are available on this essential part of the trauma patient’s journey. Two of the KPIs are related to rehabilitation with the introduction of a 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 major trauma service 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 in the future.

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 intend to use PROMS$^{16}$ in order to gather data on functional outcome and quality of life, and work is progressing to introduce these measures in 2017.

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 Care$^{17}$ within Information Services Division (ISD) 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 our effectiveness, and works more efficiently 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 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 governance process in STAG 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 who have a mortality rate that is statistically higher than the Scottish mean was piloted this year and we are grateful to the support and cooperation of the staff at Inverclyde
Royal Hospital in testing this process and for agreeing to describe this process for this report (page xx) and at the STAG National Meeting in November.

Annual visits to the four Major Trauma Networks will be introduced in 2017 and more details will be on the STAG website next year.

**Audit of the Audits**

The Scottish Healthcare Audits Team (SHA)\(^7\) was commissioned by the Clinical Outcomes for Quality Improvement (COMQI) working group of the Scottish Government to carry out an ‘audit of the audits’. This was done in collaboration with Healthcare Quality Quest\(^8\). STAG was one of the audits in this review. The objective of the review was:

- To describe the scope and characteristics of the Scottish Healthcare Audits;
- To outline how the audit contributes to monitoring/improving patient care and service delivery resulting in better outcomes for patients;
- To map stakeholder engagement with the audits including describing the outputs and target audience for disseminating information; and
- To identify examples of ‘best practice’ and present an opportunity to share these.

A proforma was used to gather as much information as possible on each audit to allow an assessment to be made on their performance against the “International standards for the operation of a national clinical audit or equivalent activities” as published by Healthcare Quality Quest\(^9\). Following an international collaboration a scoring mechanism was developed and it was agreed the SHA would use this for the ‘audit of the audits’ as a pilot with the opportunity to feed back to those involved any limitations or shortcomings within the system.

**STAG** achieved a total score of 99 which means according to the evaluation framework “The audit is generally well designed or executed, but some issues need to be defined or clarified”. The submission did not score maximum points in 20 of the 30 categories resulting in a number of recommendations.

**Recommendations**

1. There are improvements that can be made to the governance function in order to be in line with Standard 2 e.g. overseeing facilitation in improvement and monitoring levels of satisfaction of participants (scored 3/5).
2. Publish the project plan, roles and responsibilities in line with Standard 5 (scored 3/5).
3. Increase participation to include all hospitals and consider further requirements of Standard 6 (scored 3/5).
4. Roll out greater reliability testing across participating sites in line with Standard 17 (scored 2/5).
5. Work collaboratively with Health Improvement Scotland to understand what improvement methodologies the audit should offer in line with Standard 23 (scored 1/5).
6. Assess the viability of increasing the formality of reliability of data in line with Standard 27 (scored 2/5).

Work has already begun on recommendations 1, 3, 4 and 6 and progress with the other recommendations being addressed in the near future.
Use of STAG data in research

The STAG research subgroup was brought together in August 2013 with two main objectives:

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

This group has worked to develop 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.

Two large Information requests were undertaken in 2016, one on behalf of the Major Trauma Oversight Group and another which reviews the management of patients with severe head injuries. Both of these requests have taken approximately three to four weeks of analytical resource as opposed to two to three days for most other requests for data or analysis. The delay for clients receiving data remains problematic due to the prioritisation of core work however STAG remain committed to supplying information as soon as possible to maximise the benefit from the data we collect.

Two presentations at the 2016 STAG National Meeting (www.stag.scot.nhs.uk for details) will be from clinicians who have received information requests from STAG in 2015 and 2016.
Conclusion

Thanks to our National STAG Team, the highly labour-intensive recoding and data-cleansing exercise is now complete and STAG has a world-class trauma database that holds information on over 17000 patients who were treated during 2011 – 2015. Scotland now has a large, high quality data-set that can be used for future planning of trauma services; assisting in quality improvement and in research into trauma care across all our hospital sites.

The 2016 report concentrates on 6034 patients who were treated in 20 hospitals during 2014 and 2015. During this time period, the major reorganisation of services in Greater Glasgow and Clyde was completed which has resulted in the closure of the Western Infirmary, Victoria Infirmary and Southern General Hospitals in mid-2015 and the opening of the Queen Elizabeth University Hospital to replace them. We thank the staff at these hospitals for their support and contribution to STAG since its inception in 1992. 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. For the first time, we have been able to include paediatric data by expanding data collection to the Royal Hospital for Children (Glasgow) from June 2015. There are a further 12 hospitals that NHS Scotland expects to contribute to STAG in future.

2015 brought a peak in the absolute number (748) and proportion (23%) of major trauma (ISS>15) cases when compared to 2011-2014. In contrast, 2014 saw a trough in the absolute number (565) of major trauma cases. Some of this variation can be explained by variation in data collection (figures 1.1 and 1.2). Although we saw a peak in numbers in 2015, it is important to note that this still represents an underestimate of the total workload for all of Scotland.

There has been no change in the distribution of the modes of arrival or in the pattern of attendance across the week. There remains a peak in activity at the weekends and in the out-of-hours periods. 17% of these patients present between midnight and 8am.

There has been no change in the sex distribution with the majority of patients being male, as would be expected. There has been no change in the predominant mechanisms of injury which continue to be falls and moving vehicle accidents. There is, however, a marked difference between men and women, with falls being by far the commonest mechanism of injury in women. Men’s presenting injuries are more evenly split between moving vehicle accidents and falls. The proportion of penetrating injuries has remained static at around 4%. These are almost all a consequence of an assault. The consumption of alcohol also remains a common contributory factor, particularly in men.

The proportion of patients who were transferred was 11% during the time-period 2011 – 2015. The centralisation of emergency care within the city of Glasgow does not appear to have influenced this figure but it should be remembered that any impact would only have occurred in the last six months of 2015. A surprisingly large proportion of patients are transferred after they have left the ED to spend some time in another part of the hospital. Even in the major trauma group only 56% are transferred directly from the ED.

The overall mortality rate for patients included in STAG is 6%, rising to 22% for the major trauma patient group (ISS>15). In 2014 – 2015 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.

The most striking note to make about the performance against the QIs is the wide variation between hospitals and within hospitals. This has been a consistent feature across the years. We have noted improvements in the proportion of patients who receive an ambulance service pre-alert; in Consultant involvement in the ED; in the proportion referred to Neurosurgery and in the time of administration of IV antibiotics, where indicated. Unfortunately there has been no change
in the proportion of patients with a severe head injury who receive a CT scan within an hour. This remains at <40% however 68% – 70% do have a scan within two hours. Despite a rise in referrals to Neurosurgery whilst the patient is in the ED, we have noted a downward trend in transfers for Neurosurgical care for those with severe head injury.

We have been able to report an increase in the number of centres that are holding regular multi-disciplinary meetings based around their local STAG data. This should translate into a reduction in the variation in performance against QIs.
List of References


17. The Public Health and Privacy Panel for Health and Social Care
   http://www.informationgovernance.scot.nhs.uk/pbpphsc/ [Last accessed 27th September 2016]

18. Healthcare Quality Quest http://www.hqq.co.uk/ [Last accessed on 27th September 2016]

## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS</td>
<td>Abbreviated injury scale</td>
</tr>
<tr>
<td>BASICS</td>
<td>British Association of Immediate Care</td>
</tr>
<tr>
<td>CT</td>
<td>Computerised tomography</td>
</tr>
<tr>
<td>ED</td>
<td>Emergency department</td>
</tr>
<tr>
<td>EM</td>
<td>Emergency Medicine</td>
</tr>
<tr>
<td>eSTAG</td>
<td>Electronic data collection tool, STAG</td>
</tr>
<tr>
<td>GCS</td>
<td>Glasgow coma scale</td>
</tr>
<tr>
<td>HQQ</td>
<td>Healthcare Quality Quest</td>
</tr>
<tr>
<td>ICD10</td>
<td>International Statistical Classification of Diseases and Related Health Problems 10th Version</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>IQR</td>
<td>Interquartile range</td>
</tr>
<tr>
<td>ISD</td>
<td>Information Services Division</td>
</tr>
<tr>
<td>ISS</td>
<td>Injury severity score</td>
</tr>
<tr>
<td>IV</td>
<td>Intra venous</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
</tr>
<tr>
<td>LAC</td>
<td>Local Audit Coordinator</td>
</tr>
<tr>
<td>LOS</td>
<td>Length of stay</td>
</tr>
<tr>
<td>MTC</td>
<td>Major Trauma Centre</td>
</tr>
<tr>
<td>MTS</td>
<td>Major Trauma Service</td>
</tr>
<tr>
<td>NHS</td>
<td>National Health Service</td>
</tr>
<tr>
<td>PHI</td>
<td>Public Health and Intelligence</td>
</tr>
<tr>
<td>PROMS</td>
<td>Patient Reported Outcome Measures</td>
</tr>
<tr>
<td>Ps12</td>
<td>Probability of Survival 12</td>
</tr>
<tr>
<td>QI</td>
<td>Quality Indicator</td>
</tr>
<tr>
<td>SAS</td>
<td>Scottish Ambulance Service</td>
</tr>
<tr>
<td>SHA</td>
<td>Scottish Healthcare Audits</td>
</tr>
<tr>
<td>SIU</td>
<td>Spinal Injuries Unit</td>
</tr>
<tr>
<td>SMR01</td>
<td>Scottish Morbidity Record 01</td>
</tr>
<tr>
<td>STAG</td>
<td>Scottish Trauma Audit Group</td>
</tr>
<tr>
<td>STN</td>
<td>Scottish Trauma Network</td>
</tr>
<tr>
<td>TARN</td>
<td>Trauma Audit and Research Network</td>
</tr>
<tr>
<td>TRISS</td>
<td>Trauma and Injury Severity Score</td>
</tr>
<tr>
<td>TU</td>
<td>Trauma Unit</td>
</tr>
<tr>
<td>TXA</td>
<td>Tranexamic acid</td>
</tr>
</tbody>
</table>
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 (Fig 1.1 and 1.2, pages 1 and 2).

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

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).

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) 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 on 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 $^{12}$ . 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 222 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 $^{12}$ ) 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 Score (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 mortality.
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 P12 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, P14 which includes pre-existing medical conditions of patients and a ‘true’ 30-day outcome. STAG will start using this model in 2017, at the same of 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 5.1 and 5.2 are 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. Because the confidence intervals get smaller as the numbers of admissions get larger, 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. And 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.

Mapping 2011 and 2012 data to methodologies adopted in 2013

STAG recommenced an audit of trauma in 2011 and for two years used the AIS 1990 Revision dictionary to code injuries and TRISS\textsuperscript{5} methodology to calculate predicted survival. In 2013 STAG adopted the following updates to ensure it was using the most up to date and relevant methods and to minimise data collection and focus on patients with the most severe trauma:

- Adoption of AIS 2005 (Update 2008) dictionary.
- Implementation of TARN probability of survival model Ps 12.
- Reduction of the follow up time of patients in the audit from three months to 30 days.
- Changes to the STAG inclusion criteria to reduce the number of patients with minor injuries e.g. exclusion of specific isolated and closed lower/upper limb injuries.

The AIS 2005 (Update 2008) dictionary has more than 2000 injury descriptors and changed the severity coding for some injuries in an attempt to incorporate all trauma and to reflect the progress of current medical interventions.

In order to allow comparison of 2011 and 2012 STAG data to data collected from 2013 onwards, the first phase of the mapping process required the re-coding of all injuries coded with AIS 1990 Revision dictionary accordingly to new codes available in AIS 2005 (Update 2008) dictionary. The following decisions were taken:

- 1-2-1 coding between 1998 code and 2005 code when available.
- If the 1998 code maps to several codes in 2005: use the most frequently used code in 2013 (and first three months in 2014).
- If the 1998 code does not exist in 2005:
  - use the 2005 code which matches the 1998 description,
  - the extra injury was added to the list of original mapped codes.

A second phase of the mapping process involved:

- Re-coding the 2005 codes with a 9 score (as this doesn’t allow the calculation of an ISS).
- Re-calculation of ISS scores.
- Relevant dates (and if applicable outcomes) were updated to reflect the new 30 day follow up.
- Re-calculation of total length of stay in hospital.
- Exclusion of cases that no longer met the inclusion criteria.

Other manual checks focussed on trauma cases highlighted through a system of warning messages such suspicious values such as probability of survival and time spent in critical cares units.

Applying the changes described above had an effect on some ISS scores, trauma groupings (minor, moderate, major) and predicted outcome of patients that were published in the previous years. New LOS was not applied to other LOS measurements other than hospital LOS (eg ICU LOS) as data required to recalculate this information is not available.
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

<table>
<thead>
<tr>
<th>Description</th>
<th>Patients who have suffered significant trauma are assessed by the SAS using the SAS Trauma Triage Tool.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>The Trauma system relies on the need of the patient and the capacity of the service being matched and triage will help deliver this.</td>
</tr>
</tbody>
</table>

### 1.2 Pre alert

<table>
<thead>
<tr>
<th>Description</th>
<th>Patients who are triaged as requiring Major Trauma Centre (MTC) care are notified to the receiving hospital (pre alert).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>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.</td>
</tr>
</tbody>
</table>

### 1.3 Diversion to lower level of care

<table>
<thead>
<tr>
<th>Description</th>
<th>Patients who are triaged as requiring MTC care are taken directly to a MTC if they are within 45 minutes travel time.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Patients who are triaged and taken to MTC care are received by a consultant led trauma team.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>A consultant will have the necessary expertise and experience to effectively coordinate the initial assessment and treatment of a major trauma patient.</td>
</tr>
</tbody>
</table>

**Paediatrics**

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)

<table>
<thead>
<tr>
<th>Description</th>
<th>Patients who are triaged to MTC care and are taken to a TU should be seen by a consultant within 60 minutes of arrival.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>As 2.1.1</td>
</tr>
</tbody>
</table>
### 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 ≤ 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 ≤ 8 and/or an AIS (head) ≥ 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**
As in 2.4.1

### 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) ≥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 arrival.

**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

<table>
<thead>
<tr>
<th>Description</th>
<th>Patients admitted to a MTC have a rehabilitation plan written.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>Rehabilitation should start as soon as appropriate to enable patients to achieve their functional potential.</td>
</tr>
</tbody>
</table>

### 3.1.2 Time to assessment of rehabilitation needs

<table>
<thead>
<tr>
<th>Description</th>
<th>Patients admitted to a MTC have their rehabilitation plan written within three days of admission.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>As in 3.1.1</td>
</tr>
</tbody>
</table>

### 3.2 Functional outcome

<table>
<thead>
<tr>
<th>Description</th>
<th>Patients who have survived major trauma have their functional outcomes assessed at specified timelines.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Health Board</th>
<th>Hospital (Abbreviation if used on charts in section 4)</th>
<th>Contributing to STAG (2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHS Ayrshire and Arran</td>
<td>University Hospital Ayr</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>University Hospital Crosshouse, Kilmarnock</td>
<td>Y</td>
</tr>
<tr>
<td>NHS Borders</td>
<td>Borders General Hospital</td>
<td>N</td>
</tr>
<tr>
<td>NHS Dumfries and Galloway</td>
<td>Dumfries and Galloway Royal Infirmary (DGRI)</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Galloway Community Hospital</td>
<td>pending</td>
</tr>
<tr>
<td>NHS Fife</td>
<td>Victoria Hospital, Kirkcaldy (VHK)</td>
<td>Y</td>
</tr>
<tr>
<td>NHS Forth Valley</td>
<td>Forth Valley Royal Hospital (FVRH)</td>
<td>Y</td>
</tr>
<tr>
<td>NHS Grampian</td>
<td>Aberdeen Royal Infirmary (ARI)</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Dr Grays Hospital, Elgin</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Royal Aberdeen Children’s Hospital</td>
<td>pending</td>
</tr>
<tr>
<td>NHS Greater Glasgow &amp; Clyde</td>
<td>Glasgow Royal Infirmary (GRI)</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Inverclyde Royal Hospital (IRH)</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Royal Alexandra Hospital, Paisley (RAH)</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Royal Hospital for Children, Glasgow</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Queen Elizabeth University Hospital, previously Southern General Hospital, Glasgow (SGH)</td>
<td>Y</td>
</tr>
<tr>
<td>NHS Highland</td>
<td>Belford Hospital, Fort William</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Caithness General Hospital</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Lorn and Islands District General Hospital, Oban</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Raigmore Hospital, Inverness</td>
<td>Y</td>
</tr>
<tr>
<td>NHS Lanarkshire</td>
<td>Hairmyres Hospital, East Kilbide</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Monklands Hospital, Airdrie</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Wishaw Hospital</td>
<td>Y</td>
</tr>
<tr>
<td>NHS Lothian</td>
<td>Royal Infirmary of Edinburgh (RIE)</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>St John’s Hospital, Livingston</td>
<td>Pending</td>
</tr>
<tr>
<td></td>
<td>Royal Hospital for Sick Children, Edinburgh</td>
<td>Pending</td>
</tr>
<tr>
<td>NHS Orkney</td>
<td>Balfour Hospital, Kirkwall</td>
<td>N</td>
</tr>
<tr>
<td>NHS Shetland</td>
<td>Gilbert Bain Hospital, Lerwick</td>
<td>N</td>
</tr>
<tr>
<td>NHS Tayside</td>
<td>Ninewells Hospital, Dundee</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Perth Royal Infirmary (PRI)</td>
<td>Y</td>
</tr>
<tr>
<td>NHS Western Isles</td>
<td>Western Isles Hospital, Stornoway</td>
<td>N</td>
</tr>
</tbody>
</table>

Note: Data taken from A&E data mart (last updated January 16).
Acknowledgements

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>Health Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms Sarah Dickie</td>
<td>Head of Nursing</td>
<td>NHS Forth Valley</td>
</tr>
<tr>
<td>Mrs Hazel Dodds</td>
<td>Senior Nurse</td>
<td>Scottish Healthcare Audits, NHS National Services Scotland</td>
</tr>
<tr>
<td>Mr Malcolm WG Gordon</td>
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