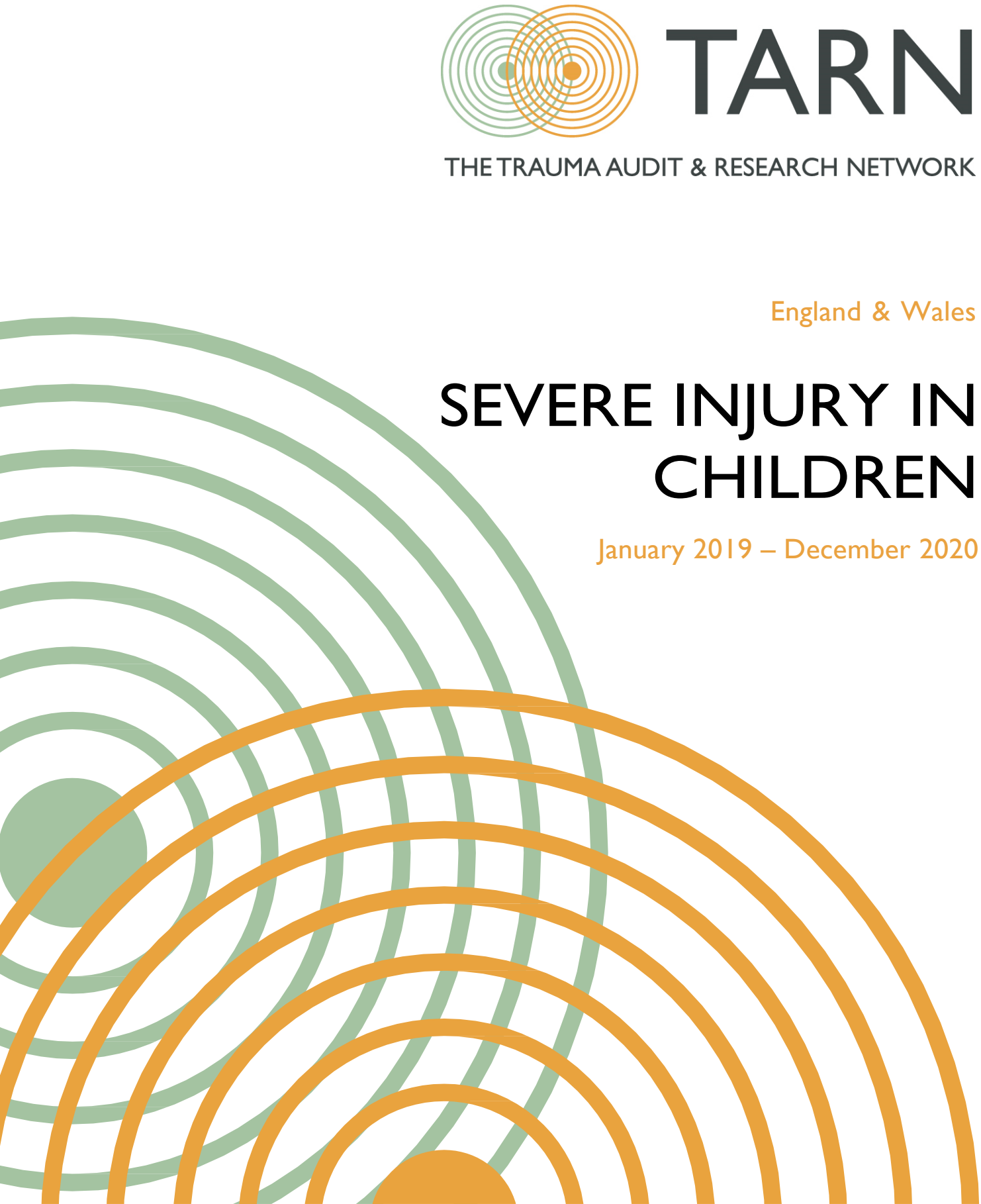


TARN

THE TRAUMA AUDIT & RESEARCH NETWORK

England & Wales

SEVERE INJURY IN CHILDREN

January 2019 – December 2020

Contents

The TARNlet Committee 5
Foreword 6
Introduction 6
Summary 8
Case ascertainment 10
Demographics of severely injured children 2019-2020 11
Injury type 12
Injury Mechanism 13
Mode of arrival to hospital 23
Arrival at hospital 25
Patients seen by a consultant in ED 32
Definitive airway management 34
Surgery 37
Patients admitted to ICU / HDU 39
Length of stay in hospital 40
Transfers 41
Patients remaining in a Trauma Unit 42
Mortality 43

Glossary 45
Appendix: Data tables and figures 47

Previous Reports

Previous reports since 2012 can be downloaded by clicking on the report links below

2012

2013 – 2014

2015 – 2016

2017 – 2018

The TARNlet Committee

Professor Ross Fisher
Chairman of TARNlet
Consultant in Paediatric Surgery
Sheffield Children's NHS Foundation Trust

Professor Tim Coats
Professor of Emergency Medicine
University of Leicester

Ms Naomi Davis
Consultant in Paediatric Orthopaedic Surgery
Royal Manchester Children's Hospital

Dr Patrick Davies
Consultant in Paediatric Intensive Care
Nottingham Children's Hospital

Dr Lorcan Duane
Consultant in Emergency Medicine
Royal Manchester Children's Hospital

Antoinette Edwards
Executive Director
The Trauma Audit & Research Network

Dr Chris Fitzsimmons
Consultant in Emergency Medicine
Sheffield Children's NHS Foundation Trust

Nathan Griffiths
Paediatric Nurse Consultant
Salford Royal NHS Foundation Trust

Samantha Jones
Major Trauma Co-ordinator/ Academic Clinical Fellow
Royal Manchester Children's Hospital

Professor Fiona Lecky
Professor of Emergency Medicine
University of Sheffield

Dr Ciara Martin
Consultant in Emergency Medicine
The Adelaide and Meath Hospital, Incorporating The National Children's Hospital, Tallaght, Dublin

Dr Samantha Negus
Paediatric Radiologist
Surrey and Sussex Hospitals NHS Trust

Mr Roberto Ramirez
Consultant in Paediatric Neurosurgery
Royal Manchester Children's Hospital

Miss Alice Roberts
Patient & Public Representative

Professor Damian Roland
Consultant and Honorary Professor in Paediatric Emergency Medicine
University of Leicester

Professor Ralph MacKinnon
Consultant, Department of Paediatric Anaesthesia
Royal Manchester Children's Hospital

Acknowledgements
We would like to thank the staff at each trauma receiving hospital and Paul Symonds, Data Analyst at the Trauma Audit and Research Network.

2 Years of Severe Injury in Children

Foreword

“If you can’t measure something, you can’t improve it”

This is the 4th iteration of the Children’s Trauma Report. It is hard to understate how important this report is to improving the care injured children and young people receive. It is testament to the vision of TARN that it has been possible to assess, over a decade or so, presentations and outcomes of children presenting to trauma units and centres. Specifically, this work has been invaluable in highlighting the huge burden on physical abuse on infants less than 3 months old and how inflicted injuries in young people have evolved over time. Also, well before involving the public in health care initiatives became standard, TARN have been utilising a patient representative in the report development and overview for some time.

I would recommend everyone involved in the direct care, or delivery of care, to injured children to read this report and reflect on how their local services compare with national trends. There is much to learn from this, the latest, in the series of these children’s reports and I hope it is used as a springboard to improve care to this vulnerable and diverse group of patients.

Mr Robert Bentley
FRCS, FDSRCS, FRCS(OMFS)

National Clinical Director for Major Trauma and Burns

2 Years of Severe Injury in Children

Introduction

This is the 4th biennial report from the Trauma Audit and Research Network's TARNlet paediatric trauma group and covers a time in which there were very unusual impacts on children's lives due to the Covid19 pandemic. This report contains data from the whole of the 2-year period from January 2019 to December 2020 - the specific effects of 'lockdown' are being analysed and published separately.

Injury produces a significant health burden for children, being a leading cause of both death and disability. About half of the 4 million attendances by children to EDs each year follow an injury, but most are minor. Information about the more serious injuries is collected by the Trauma Audit and Research Network (TARN), the UK's national audit of major trauma. Details of the methods used to collect data, the injury severity scoring system and the predictive model used to allow evaluation of the process and outcomes of treatment can be found on the TARN website (www.tarn.ac.uk).

Children are included in the TARN dataset if they are injured and either (1) are admitted to hospital for more than 72 hours, or (2) admitted to an intensive care area, or (3) die in hospital. Outcome (lived or died) is recorded either on discharge from hospital or at 30 days (whichever comes first). Patients who die at the incident scene and are not transported to hospital are not reported to TARN. Individual injuries are classified according to the Abbreviated Injury Scale (AIS), which allows an overall Injury Severity Score (ISS) to be calculated (giving a score of 0 to 75). Links to the details of these scoring systems are on the TARN website (www.tarn.ac.uk). Conventionally a child with an ISS of >15 is classified as 'major trauma' with an ISS of 25 or more being the most severe of injuries. Further information about the data methodology can be found at www.tarn.ac.uk

The TARNlet committee is comprised of clinicians, managers, academics and patients. All are involved in the management of children who have sustained injury and are keen that the information within the National Clinical Audit of Major Trauma should be used to optimise care. This report focusses on areas where we think improvement could be made in either the prevention of injury, or the process of care for injured children.

The Trauma Audit and Research Network (TARN) registry contains information on 4,686 children under the age of 16 injured from January 2019 to December 2020, as compared with data on 5,367 in 2017/18.

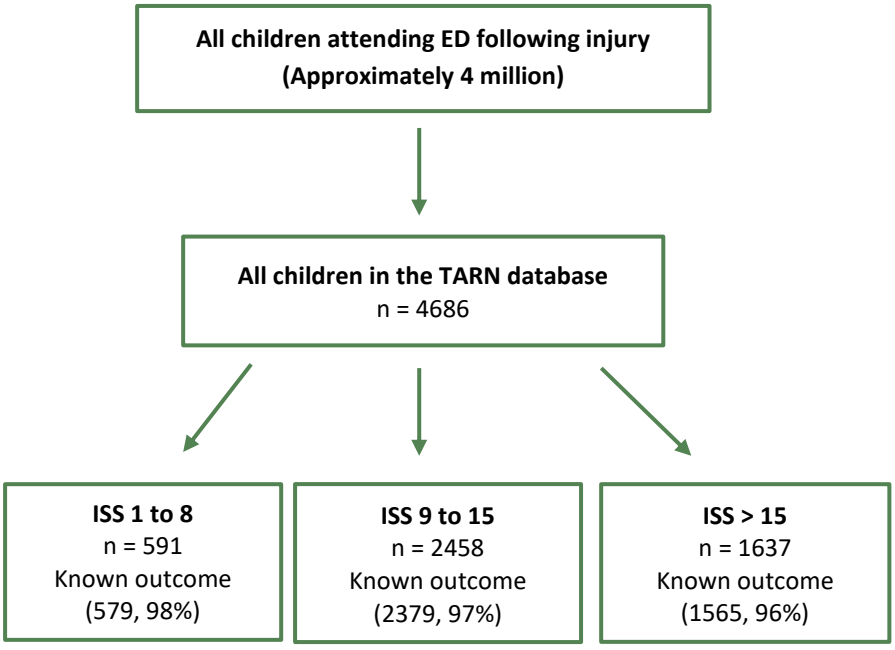


Figure 1. (January 2019 – December 2020).

This report concentrates on the 1,637 children recorded in the TARN database from January 2019 to December 2020 who sustained the most serious injuries - an injury severity score (ISS) greater than 15 (which is the conventional definition of 'major trauma').

2 Years of Severe Injury in Children

Summary

During January 2019 to December 2020 there were 1637 severely injured (ISS > 15) children treated in England & Wales. Pedestrian injury resulting in traumatic brain injury is still the commonest cause of severe injury and mortality after the age of 1 year, Suspected Physical Abuse (SPA) being the predominant cause in the first year of life. Other types of road traffic incident (vehicle occupant or cyclist) and falls (both low and high) are also common. Despite being uncommon injury mechanisms, the highest case fatality rates were for asphyxia and drowning. This is shown in the new data on the injury mechanisms and in the breakdown of patients injured in road traffic incidents.

The number of severely injured children follows a well-known seasonal pattern (peaking during the summer) and weekly pattern (more cases occurring at weekends) and daily pattern (a small morning and larger late afternoon / evening peak). The pattern of arrival of severely injured children has not changed and still implies that staffing for paediatric trauma needs to be focussed 'out of hours' to match high rates of arrival in the evening and at weekends. There continued to be few patients arriving after midnight.

Major trauma in childhood is commonest in the first year of life, the first 3 months having the highest incidence (suspected physical abuse / non-accidental injury accounting for about 10% of all major trauma in childhood). This has not changed over time, and trauma systems need to be focussed on the differing ways in which SPA* (suspected physical abuse) presents[1.] These children are not easily identified by the standard prehospital and hospital trauma triage tools and alternative tools are required.

About 25% of severely injured children are not taken to hospital by ambulance; their parents/carers are taking them to the nearest hospital (usually a Trauma Unit). Trauma systems need to anticipate that children will continue to arrive at trauma units or non-designated hospitals and have systems to ensure that children are not disadvantaged by initially presenting to the non-designated hospital. Most of these severely injured children are moved to a specialist Trauma Centre, however about a third remain in a TU. Further research is required to establish the speed of the inter-hospital transfer system for those who are moved to a MTC and to establish the outcomes for the severely injured children who remain in a TU.

Severe traumatic brain injury is still the leading numeric cause associated with death. However, new categories for the mechanism of trauma, introduced in this report, show that proportionately asphyxia and drowning have the highest relative risks for mortality. There seems to be a peak incidence in of self-harm in September and May with asphyxia continuing to be the predominant method. Further research is required to understand this trend. Public health interventions aimed at reducing these, or any other, mechanisms of injury could be monitored using the TARN system.

There is a large peak in incidence of intubation in the late afternoon, with a continuing increasing in the importance of prehospital services in airway management (intubation) for severely injured children. This may have implications for Pre-Hospital Emergency Medicine (PHEM) training and skill maintenance.

This report also demonstrates the importance of close alignment between neurosurgical and cardiothoracic services as head, chest and combined head + chest injuries are the body areas associated with most deaths. The appropriateness of the place of treatment (particularly for the third of severely injured children who are treated in a TU) needs further research in order to understand whether the current trauma treatment systems are providing optimal care.

As trauma systems evolve and mature there will be changes in the way in which the healthcare system responds to severely injured children. The TARNlet reports will present the best information that is available about our care of children and young people and continue to strive to produce data that will assist in the improvement of the delivery of trauma services.

2 Years of Severe Injury in Children

Key Areas

From this report key areas for NHS services for severely injured children are:

1. Prevention of physical abuse in the first 3 months of life.
2. Understanding the seasonal pattern of self-harm (particularly asphyxia).
3. Understanding the rate of movement of children initially presenting to a TU and the impact of rate of movement on outcome.
4. Understanding the appropriateness of care for children who remain at a TU rather than undergo transport to a MTC, and the impact on outcomes.
5. Evaluation of the training of PHEM services in paediatric airway management.

[1] A profile of suspected child abuse as a subgroup of major trauma patients
Ffion C Davies, Timothy J Coats, Ross Fisher, Thomas Lawrence, Fiona E Lecky
Emerg Med J 2015;32:921-925 doi:10.1136/emermed-2015-205285

* 'Suspected Physical Abuse' previously referred to as NAI.

2 Years of Severe Injury in Children

Case ascertainment

	All Submissions			Submissions of patients that died		
England & Wales	n	HES	Ascertainment	Deaths	HES	Ascertainment
2012 – 2014*	8188	10344	79.2%	211	111	100+%
2015 – 2016	5945	7187	82.7%	130	111	100+%
2017 – 2018	6104	6598	92.5%	133	108	100+%
2019 – 2020	5649	6462	87%	181	109	100+%

Case ascertainment is displayed as a percentage and represents the number of patients submitted to TARN compared to the number of patients expected based on the 2019/20 Hospital Episode Statistics (HES) dataset. The HES dataset is not perfect but is used as a general baseline. We found better case ascertainment for patients who die, in other words deaths are more likely to be reported to TARN. Therefore it is likely that for the more severely injured children studied in this report case ascertainment is higher (probably close to 100%). than that for all TARN eligible children on HES.

In order to be comparable to the HES data the table above shows the number of submissions from hospitals to the TARN database (n=5,463) rather than the number of unique patients (n=4,686). If a child is transferred, each hospital should submit the case to TARN – so total submissions is more comparable to Hospital Episodes than unique patients.

1,565 children had severe injuries with an injury severity score (ISS) of > 15 and 133 of these (represented by 136 submissions) died of those injuries.

	ISS > 15, all ages		ISS > 15, aged < 16	
Period	n	Deaths	n	Deaths
2012–14*	44794	6515	2295	207
2015–16	40160	6042	1647	126
2017–18	48066	6618	1786	131
2019–20	45995	6332	1565	133

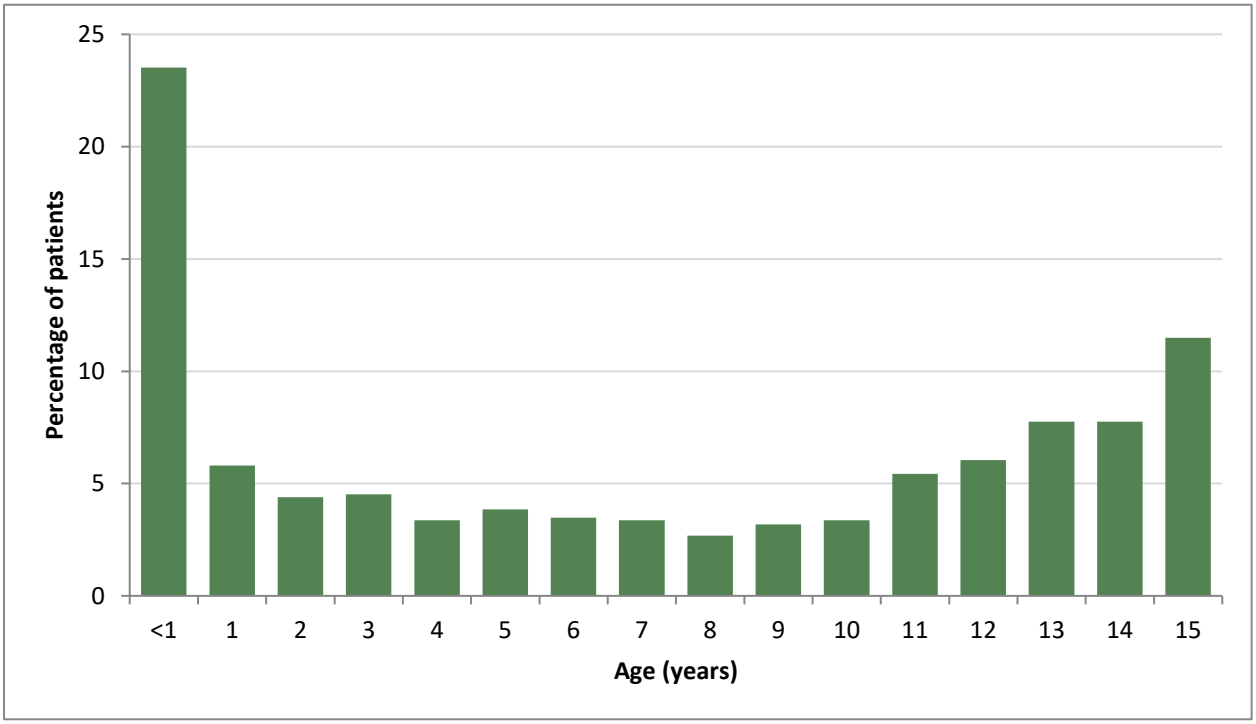
*Period represented is spans 3 years.

NOTE: The numbers of patients represented by the graphs in this report are tabulated in the Appendix.

2 Years of Severe Injury in Children

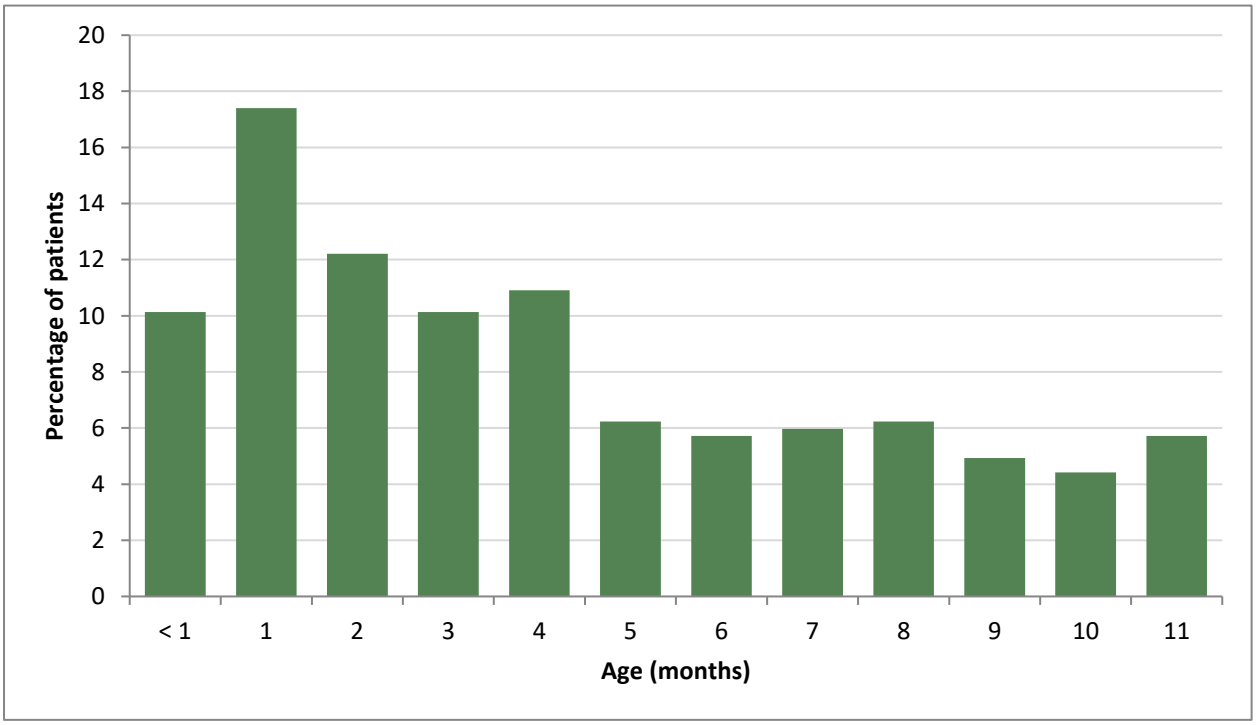
Demographics of severely injured children 2019-2020

Age breakdown by year



There is a clear peak in the first few months of life (related to SPA), with low level through early childhood until the pre-teen years when there is a rise. This pattern has not changed since 2012.

Patients aged less than 1 year – age by month

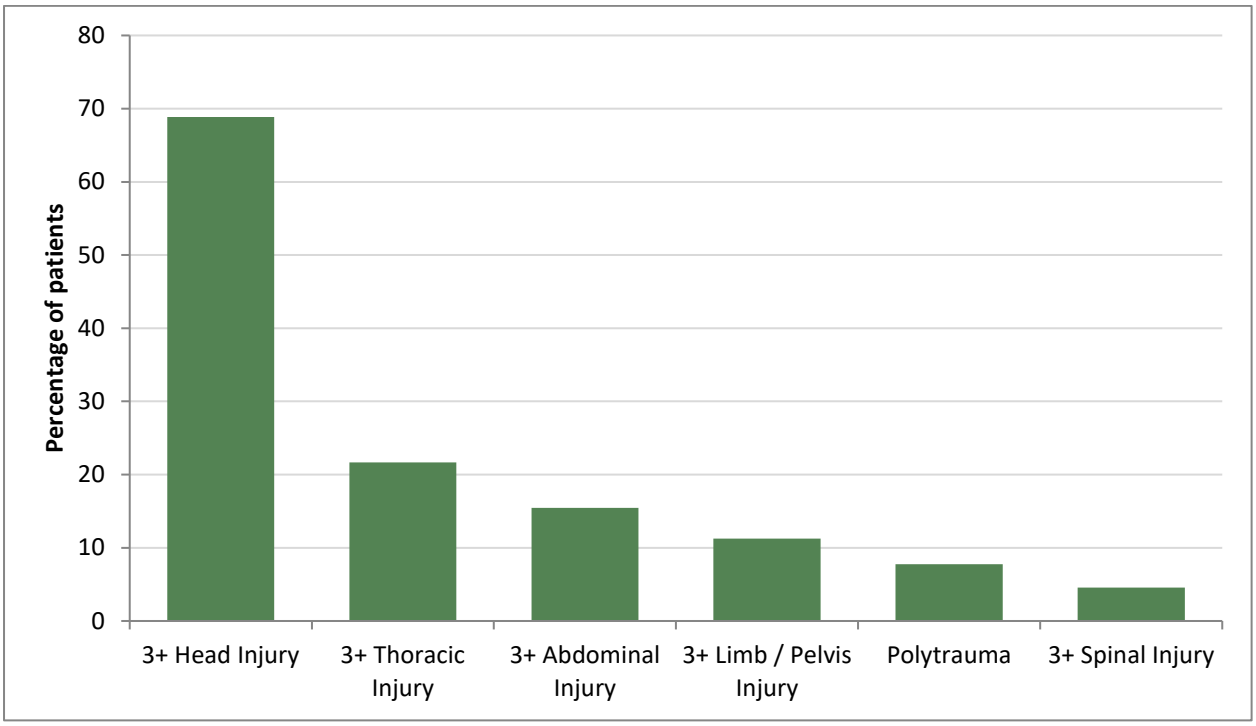


Within the first year there is a consistent pattern of more injuries within the first few months.

2 Years of Severe Injury in Children

Injury type

AIS 3 and above*



Severe traumatic brain injury is by far the commonest type of injury in children that have suffered severe trauma, emphasising the importance of early neuroprotection and neurointensive / neurosurgical care within the Trauma Networks. The very low incidence of polytrauma (AIS 3+ injuries in more than one body area) is striking and suggests that focussed CT scanning rather than whole body CT may be appropriate in children as per the 2014 Royal College of Radiologist Guidance which suggests prioritising head and abdominopelvic CT scanning, with careful consideration of the need for cervical and thoracic imaging. .

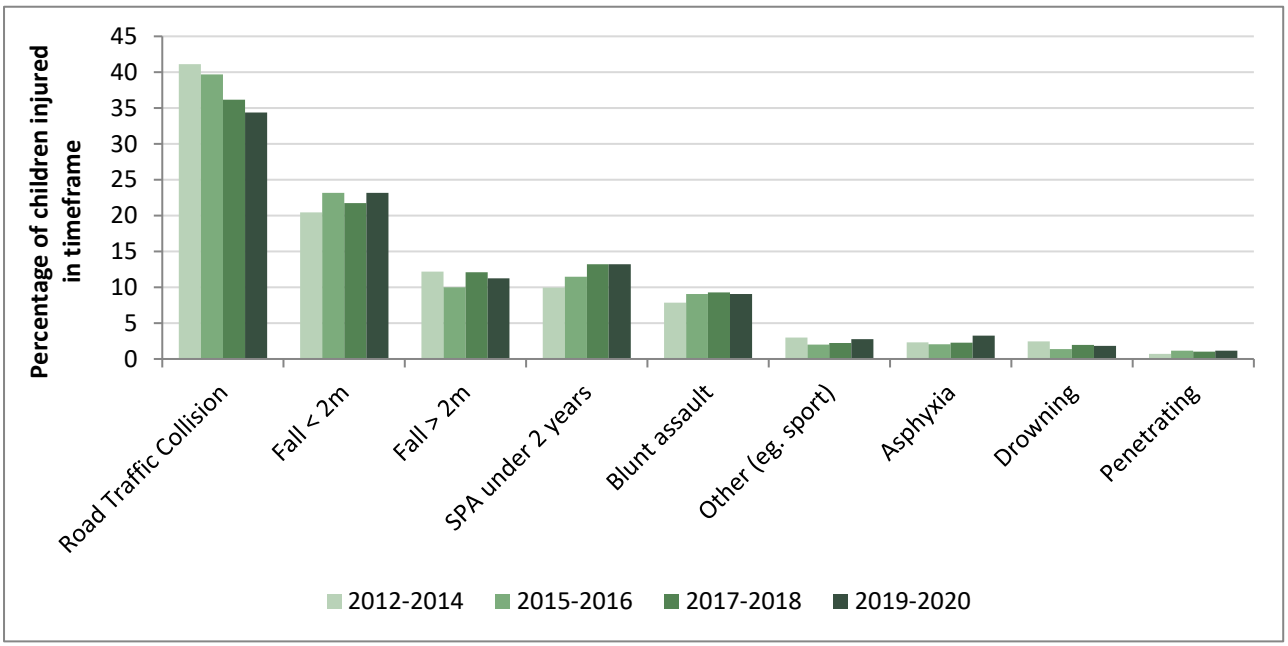
*The severity of each injury is described using the Abbreviated Injury Scale (AIS) score. The score can range from 1 (minor) to 6 (fatal). An AIS 3 head injury always involves brain injury.

**AIS 3+ injuries in multiple body regions

2 Years of Severe Injury in Children

Injury Mechanism

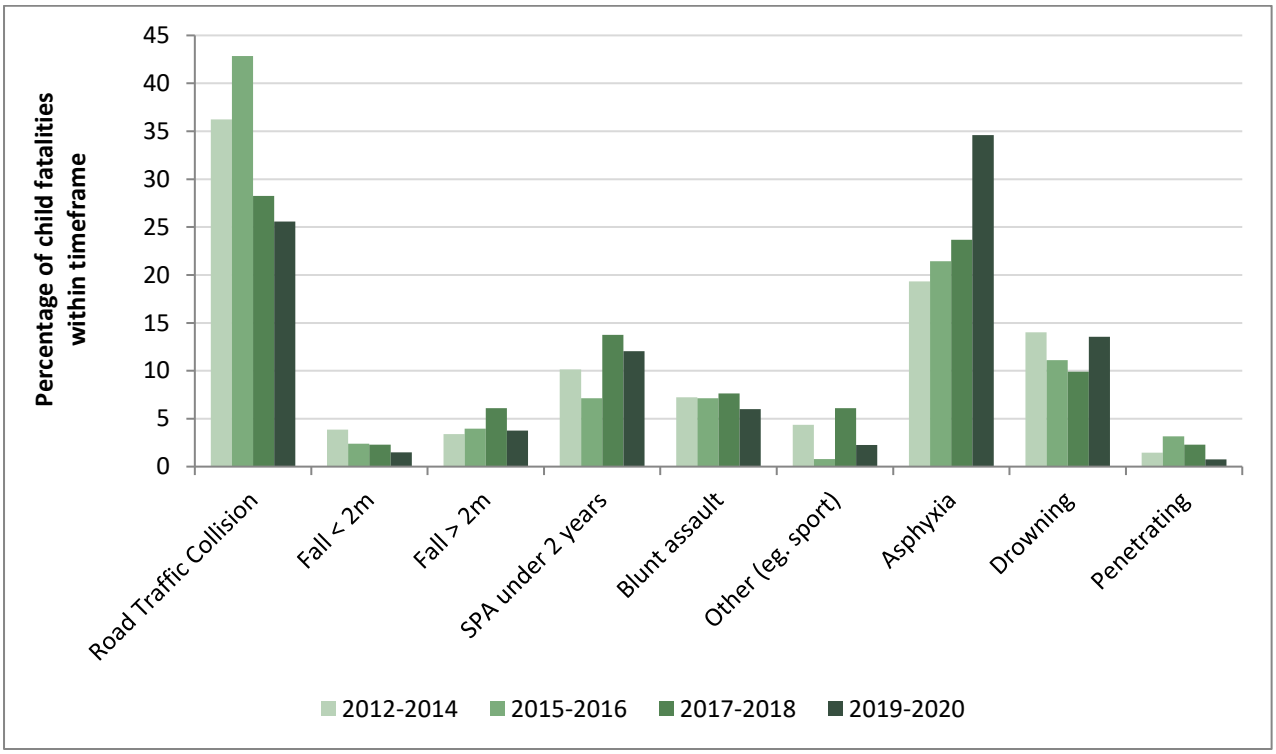
Injury Mechanism - All patients



Analysis of injury mechanism data continues to show a preponderance of road traffic incidents and falls of less than 2 metres. 13.2% of the patients were aged under 2 and injured intentionally (recorded as Suspected Non-Accidental Injury). There seems to be a pattern of a reducing proportion of childhood trauma due to road traffic collisions. It is difficult to interpret trends in the groups (such as penetrating trauma) where there are low numbers.

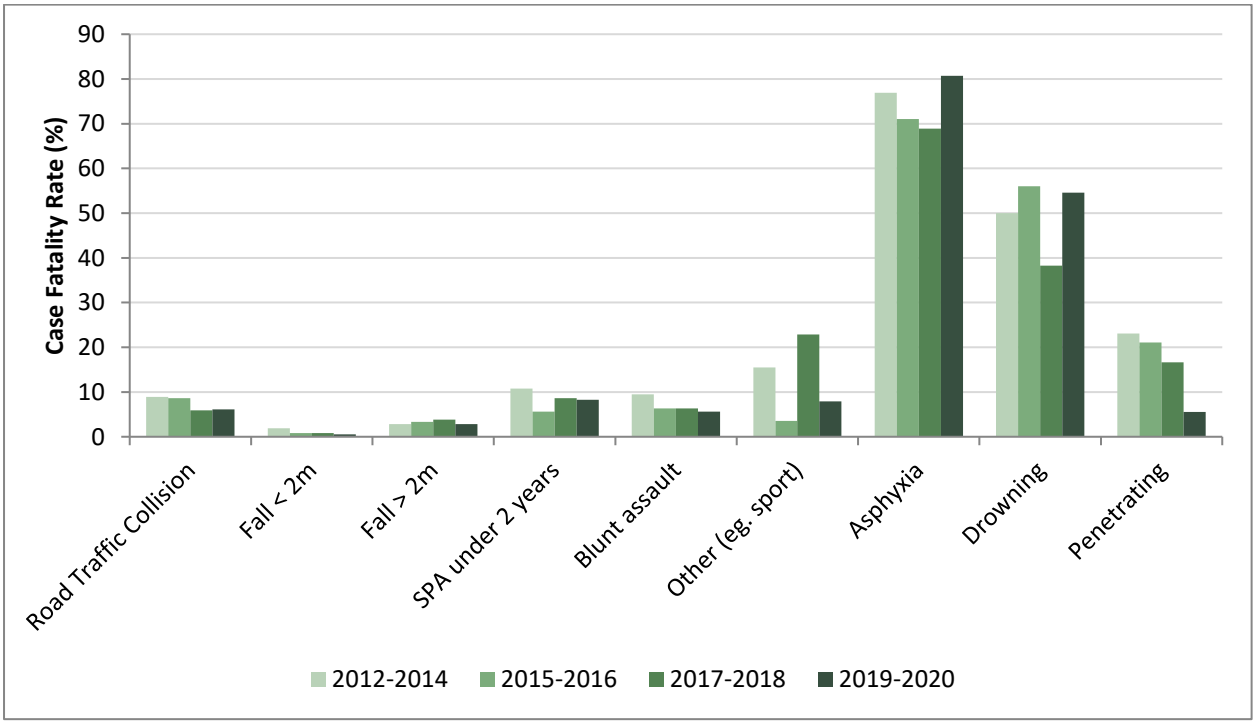
2 Years of Severe Injury in Children

Injury Mechanism – Fatalities



Asphyxia (usually self-inflicted hanging) and drowning have a disproportionately large contribution to overall number of fatalities due to a high case fatality rate. Low numbers make year to year variation difficult to interpret and the pattern in 2019-20 may have been altered by the large behavioural changes seen in society. This will become clearer with time, and a 'before / during / after' analysis which is being conducted on major trauma patterns during the Covid19 pandemic.

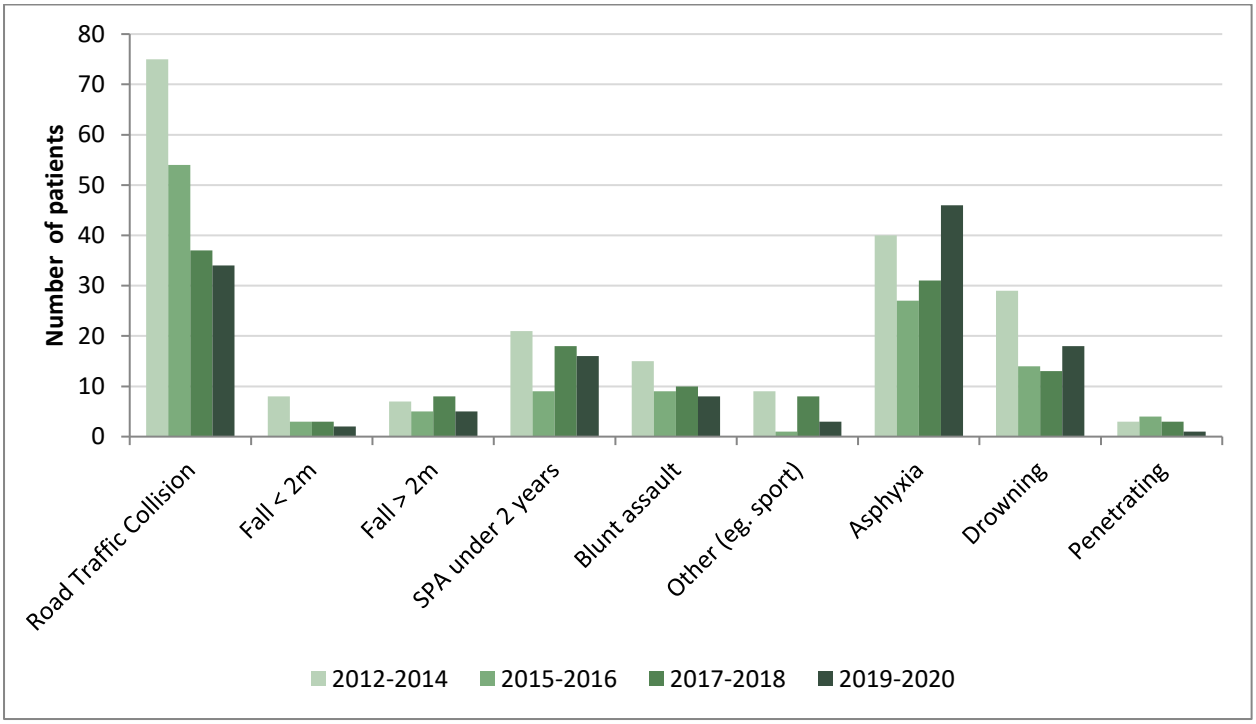
Case fatality rate by injury mechanism



The high case fatality rates for asphyxia and drowning account for the different patterns of mechanism of injury between all patients and fatalities.

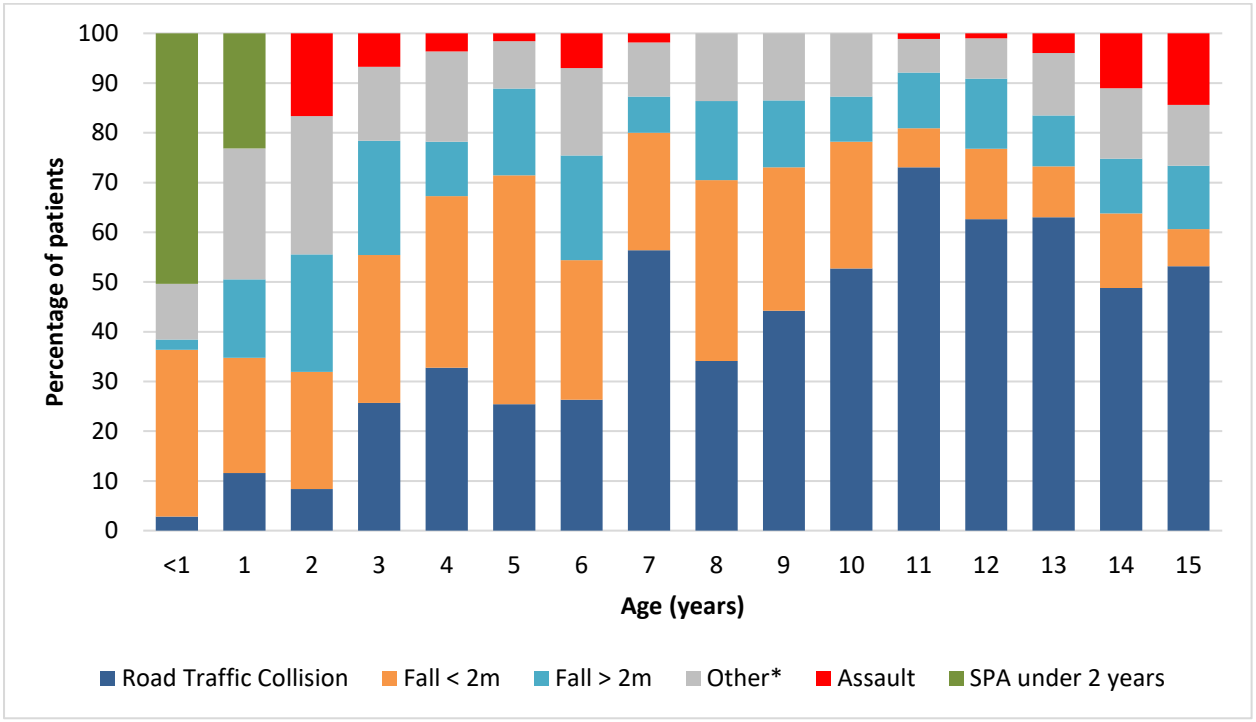
2 Years of Severe Injury in Children

Case fatality counts by injury mechanism



The absolute number of deaths within each group over time is the combination of the changes in the frequency of different injury mechanism and changes in the case fatality rates.

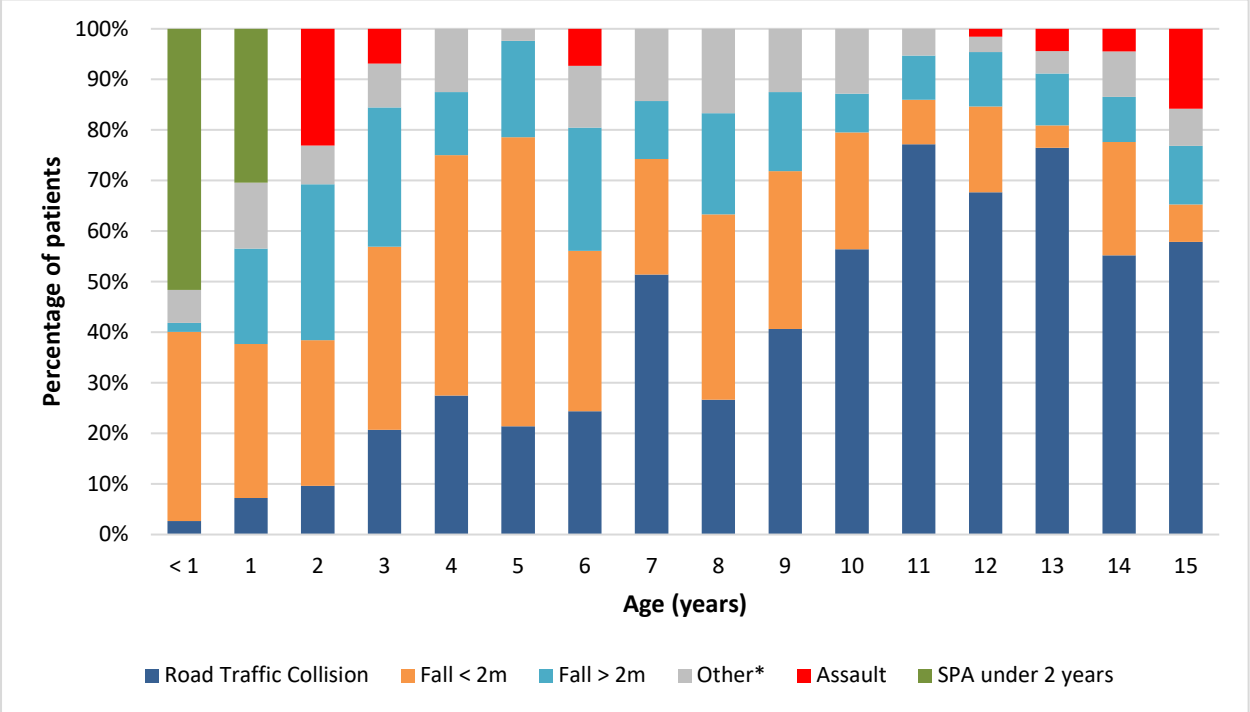
Injury mechanism by age



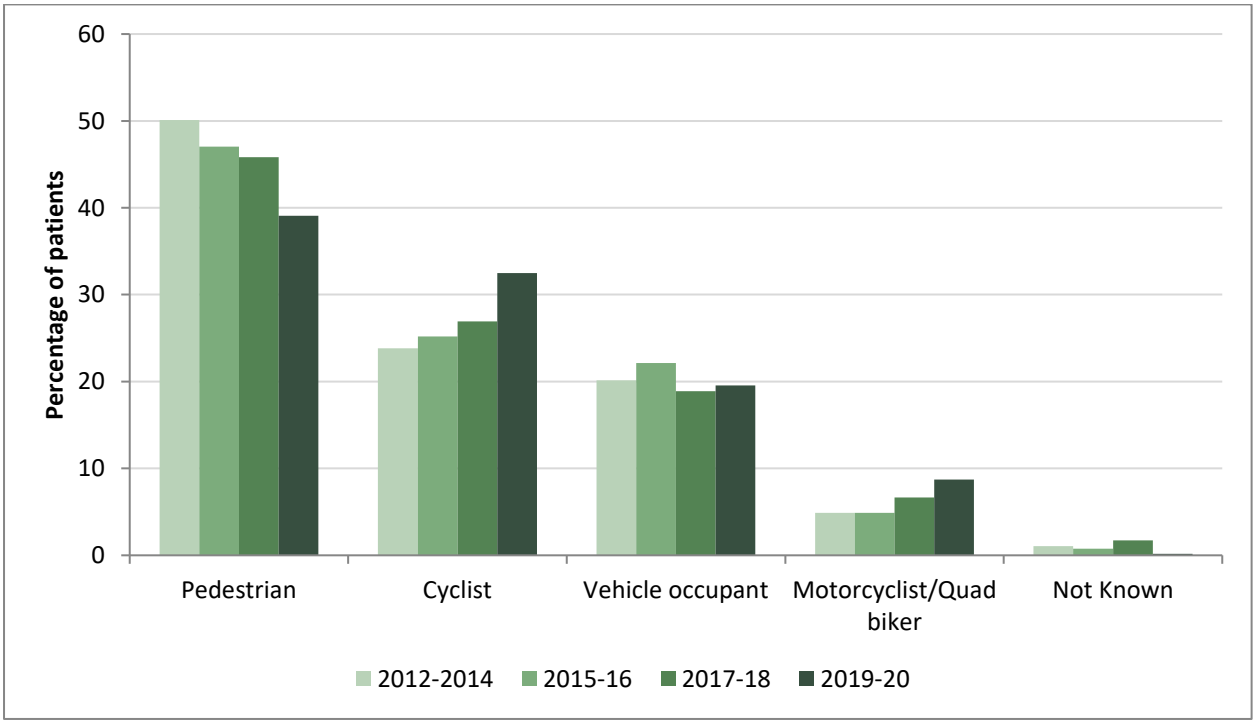
The importance of SPA <1year old has been addressed in separate TARN publications. There is a high incidence of low (<2m) falls in the younger children and road traffic collisions (child pedestrian and cyclist) become important as soon as the child become independently mobile (3 years onwards), and then increase gradually throughout childhood. A similar pattern is seen in the patients with traumatic brain injury.

2 Years of Severe Injury in Children

Injury mechanism by age for patients with Traumatic Brain Injury



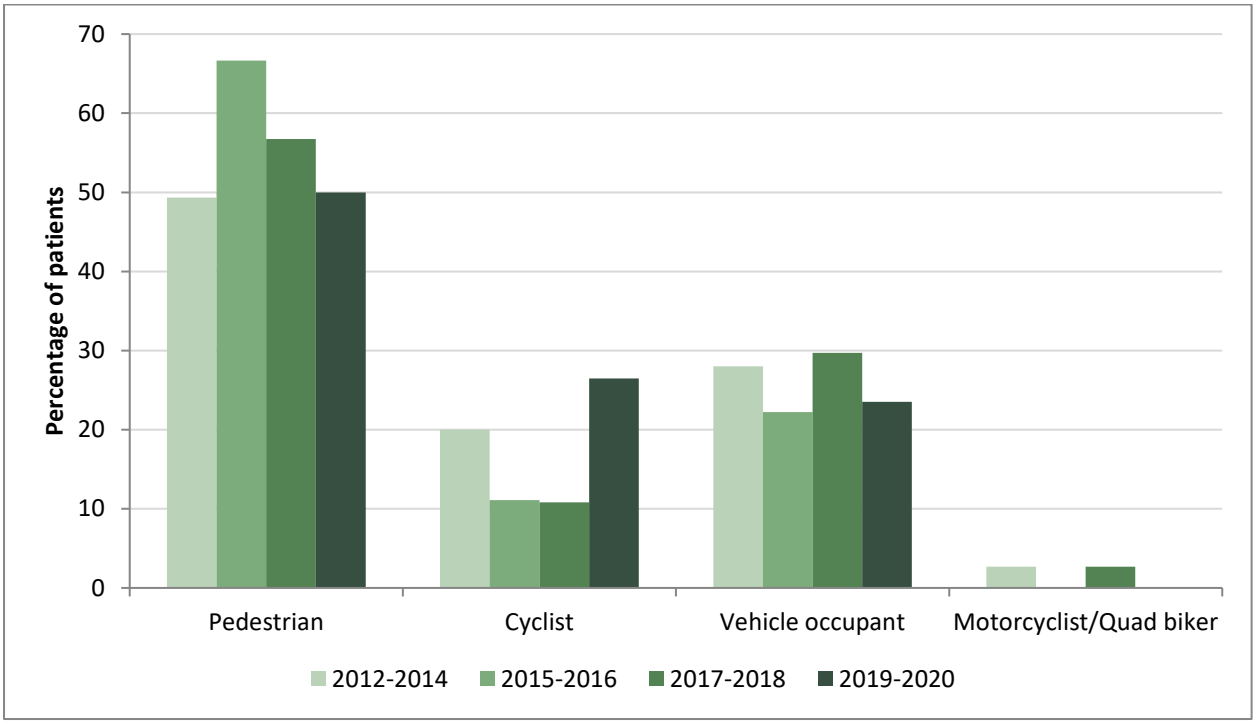
Patients injured in a road traffic incident



Children involved in road traffic incidents are mostly undertaking self-determined activities such as walking or cycling, where factors such as poor situational awareness, inexperience and distraction lead to vulnerability. Only about 20% of severe road traffic injury in children occurs when a child is within a vehicle. This may have implications for parental choice of transport and exercise levels among children. There may be an evolving trend to fewer injuries to pedestrians, but more injuries to cyclists.

2 Years of Severe Injury in Children

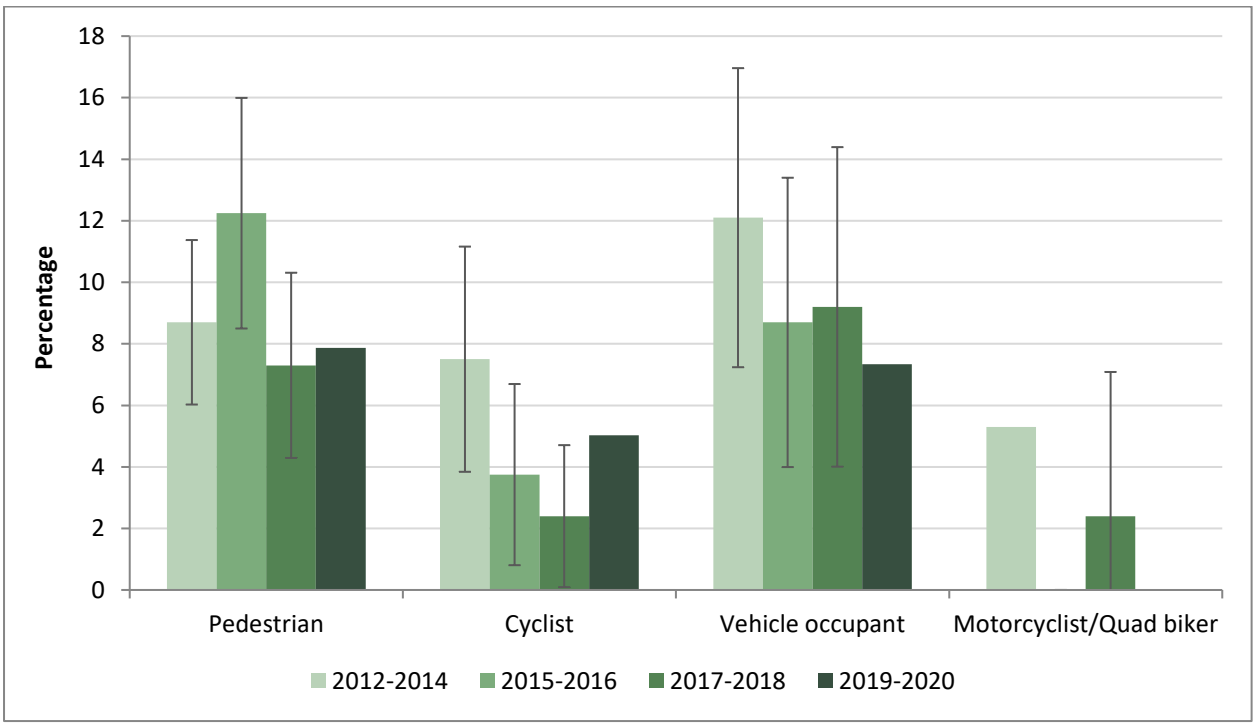
Proportion road traffic incident deaths by type of incident



2019/20 may have had a different pattern, with a greater proportion of deaths associated with cycling. A separate TARN publication is analysing the impact of Covid19 lockdowns.

2 Years of Severe Injury in Children

Mortality rate of patients injured in a road traffic incident



Road safety interventions clearly need to prioritise child pedestrians/cyclists. Factors such as separation from vehicles, decreasing the impact speed and increased awareness of risk are likely to be important.

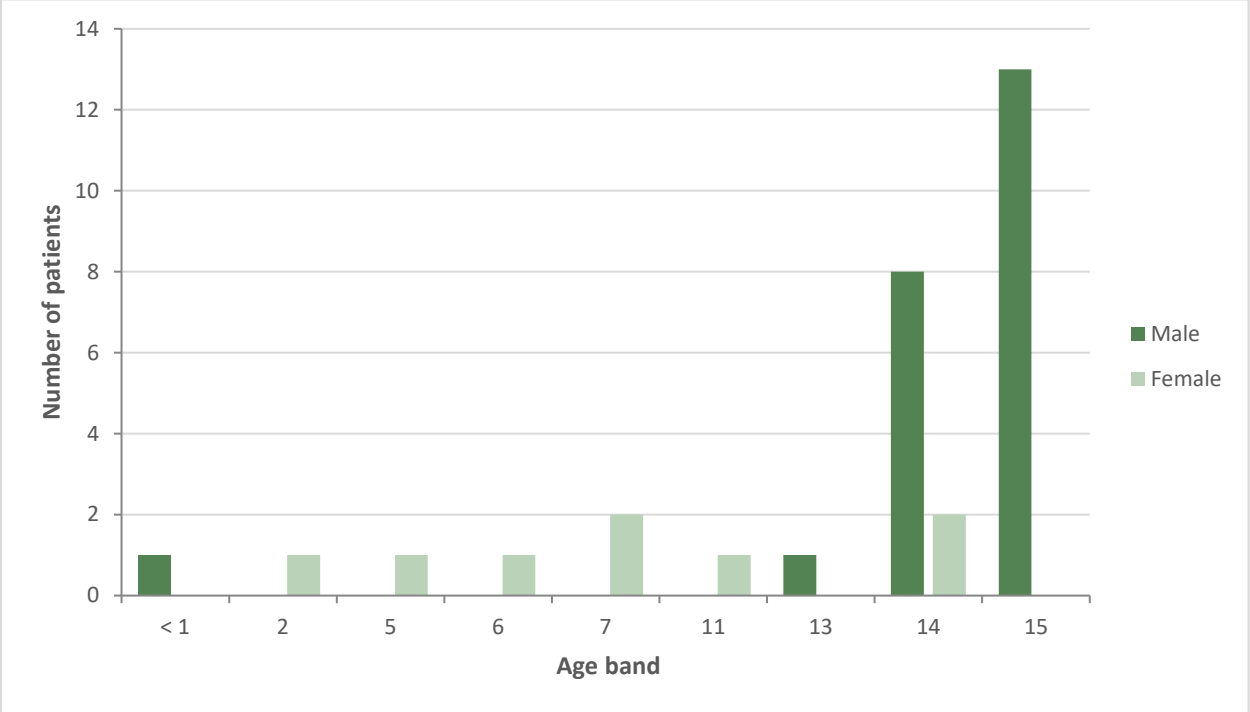
The improvement in overall mortality after severe injury have been detailed elsewhere[2]. There are insufficient numbers to detect any change in overall trauma mortality in children as a separate group.

Note: These mortality data do not include children who do not receive any treatment in hospital (prehospital deaths).

[2]Changing the system-major trauma patients and their outcomes in the NHS (England) 2008–17
Moran, Christopher G., Fiona Lecky, Omar Bouamra, Tom Lawrence, Antoinette Edwards, Maralyn Woodford, Keith Willett, and Timothy J. Coats
EClinicalMedicine 2 (2018): 13-21

2 Years of Severe Injury in Children

Stabbings by age band



Interpretation of stabbing data should bear in mind that these data only represent the most severe end of the spectrum of stab injuries. Many stabbed patients will not have severe enough injuries or long enough hospital stays to be included in the TARN dataset.

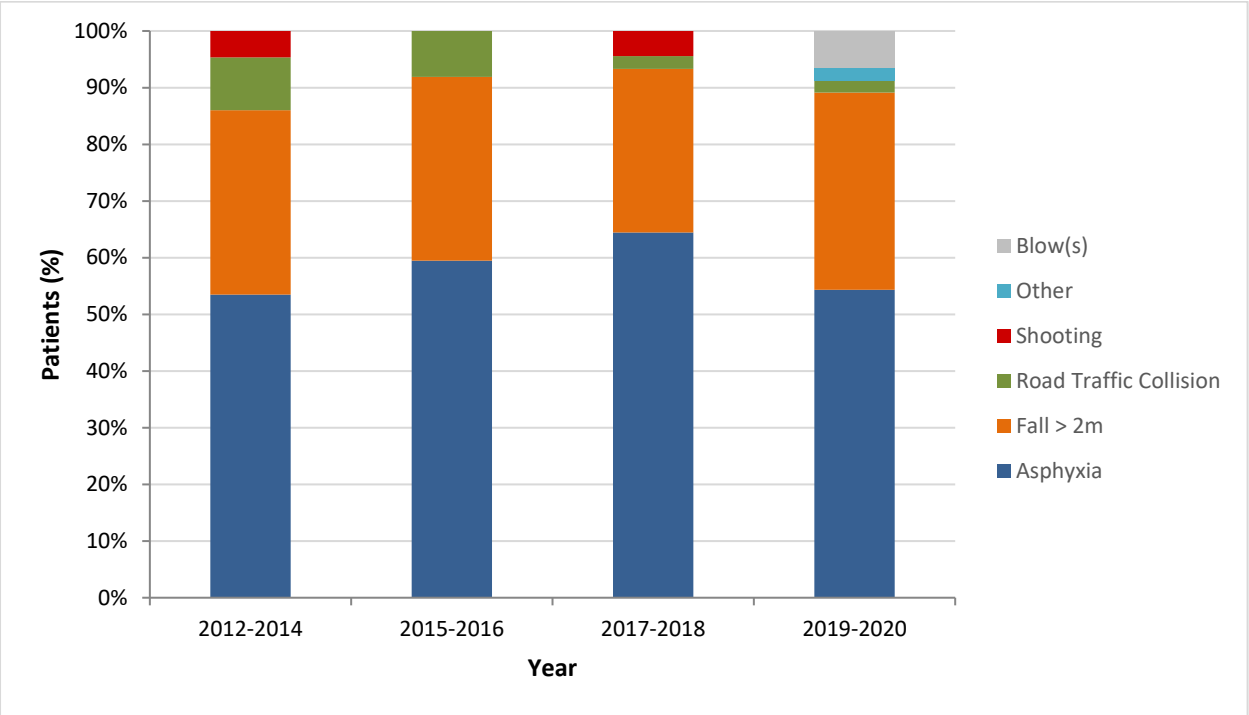
There were 31 patients in total that received a stabbing injury through an alleged assault between January 2019 to December 2020.

There is a clear start to stabbing injuries at 14 years, with few patients in younger age groups. This is one year earlier than in our previous reports, but it is unsafe to draw the conclusion that the lower tail of the stabbing peak is starting at a younger age due to the low numbers involved. Given this age distribution and the overall low numbers there is an argument that stabbed teenagers should initially be treated in ‘adult’ MTCs where there is more experience at dealing with penetrating injuries (with postoperative transfer to a paediatric care).

2 Years of Severe Injury in Children

Suspected self-harm

Recorded as self-harm, by mechanism
(n=171)



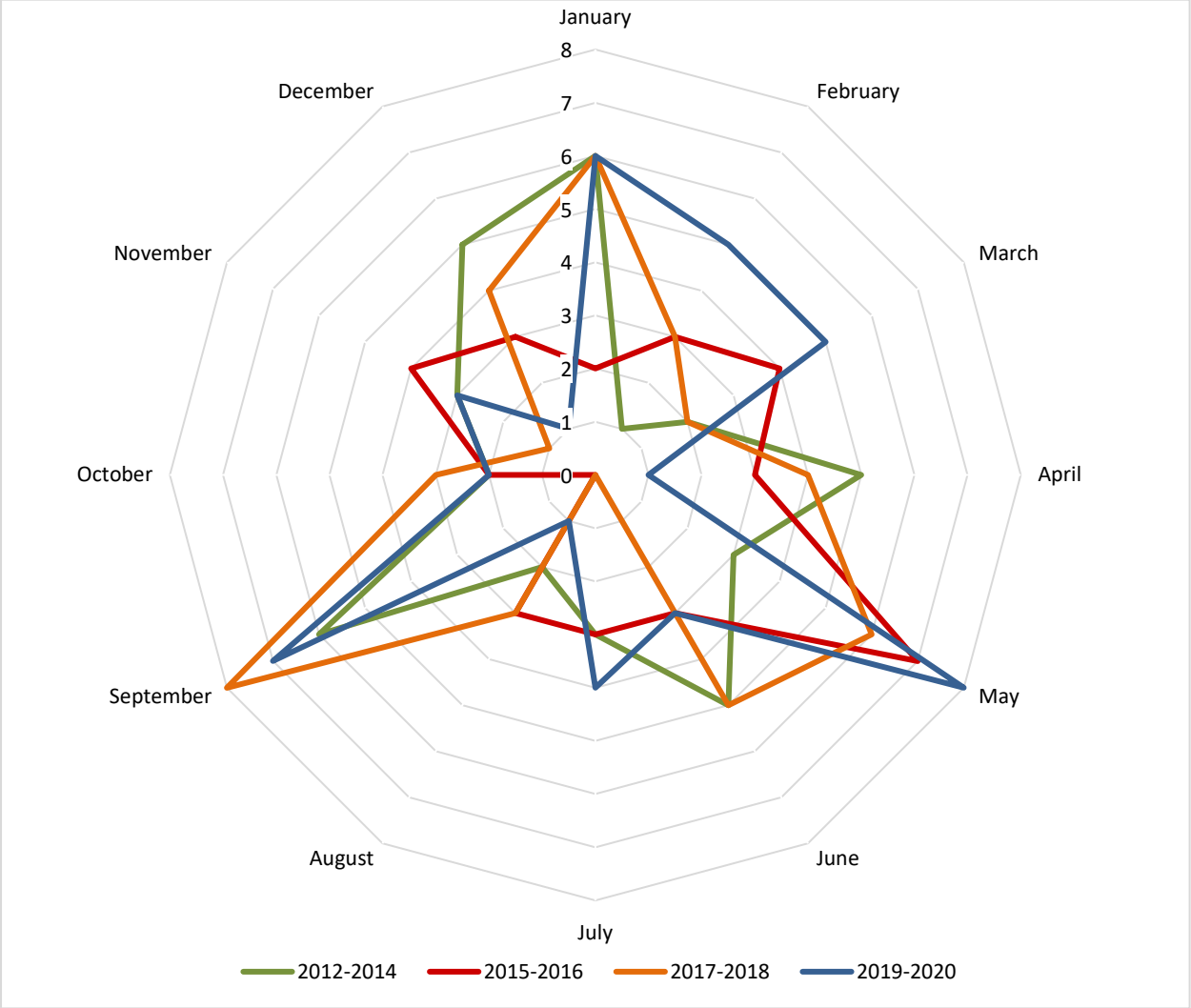
Asphyxia (hanging) remains the most frequent cause of self-inflicted major trauma in the dataset (which does not include fatalities with no hospital treatment), followed by falls from a height. This is a very different pattern of mechanisms from those seen in patients attending the ED who do not stay in hospital long enough to be in the TARN dataset (where incised wounds would be the commonest mechanism).

It should be noted that poisoning (overdoses) are not included in the TARN dataset so this is not a complete description of serious self-harm in children.

2 Years of Severe Injury in Children

Suspected self-harm

Recorded as self-harm, by month
(n=171)

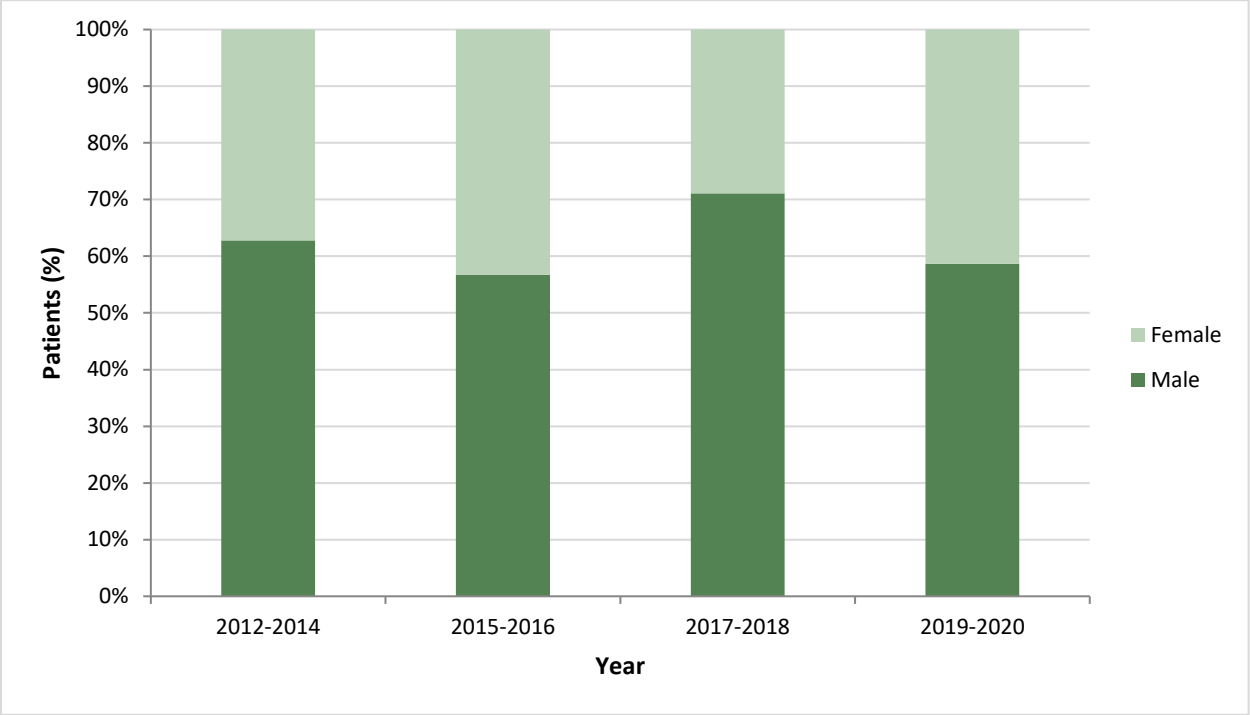


Over the four periods studied there seems to be a consistent pattern of peaks in September and May. The type of analysis does not allow conclusions about causation – but these peaks correspond to the start of the school year and the run up to exams. Further research is required to understand these patterns.

2 Years of Severe Injury in Children

Suspected self-harm

Recorded as self-harm, by gender
(n=171)

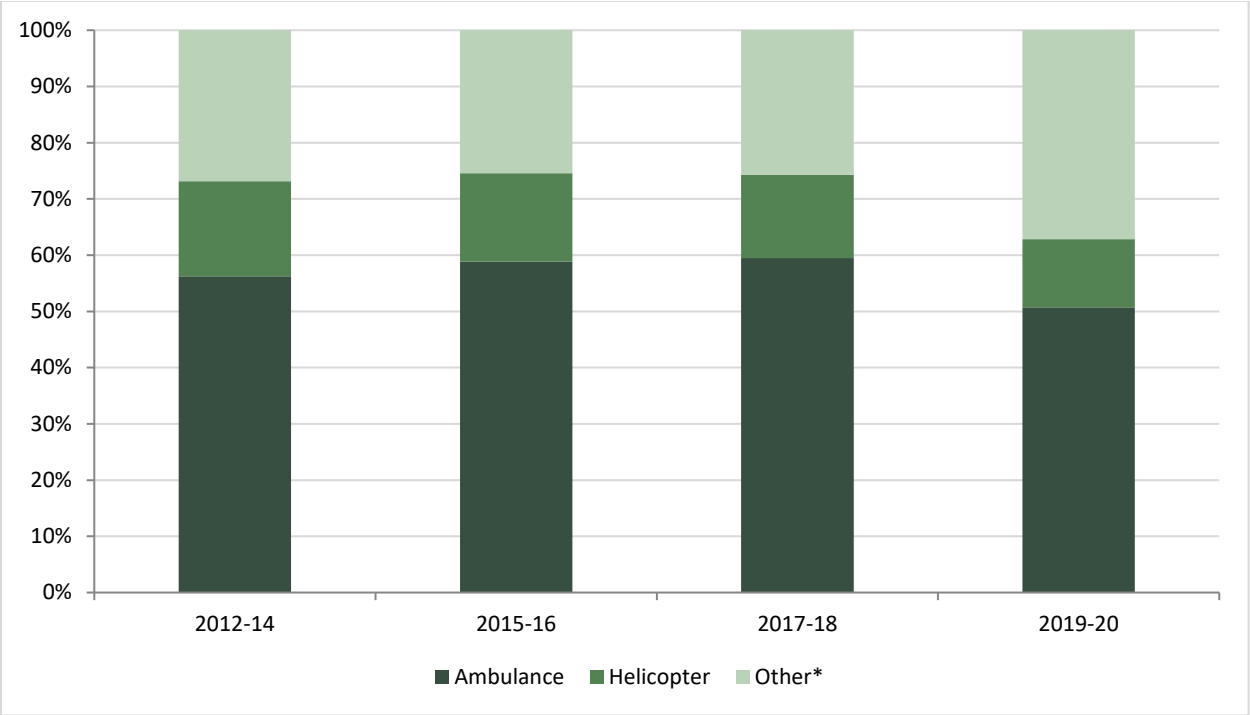


There is a continuing gender difference with more boys in the dataset due to self-harm. This could be due to gender differences in incidence but could also be related to gender difference in choice of mechanism of self-harm (as non-trauma methods of self-harm, such as poisoning, are not in this dataset).

2 Years of Severe Injury in Children

Mode of arrival to hospital

Direct admissions only
2019-2020 (n=1322)



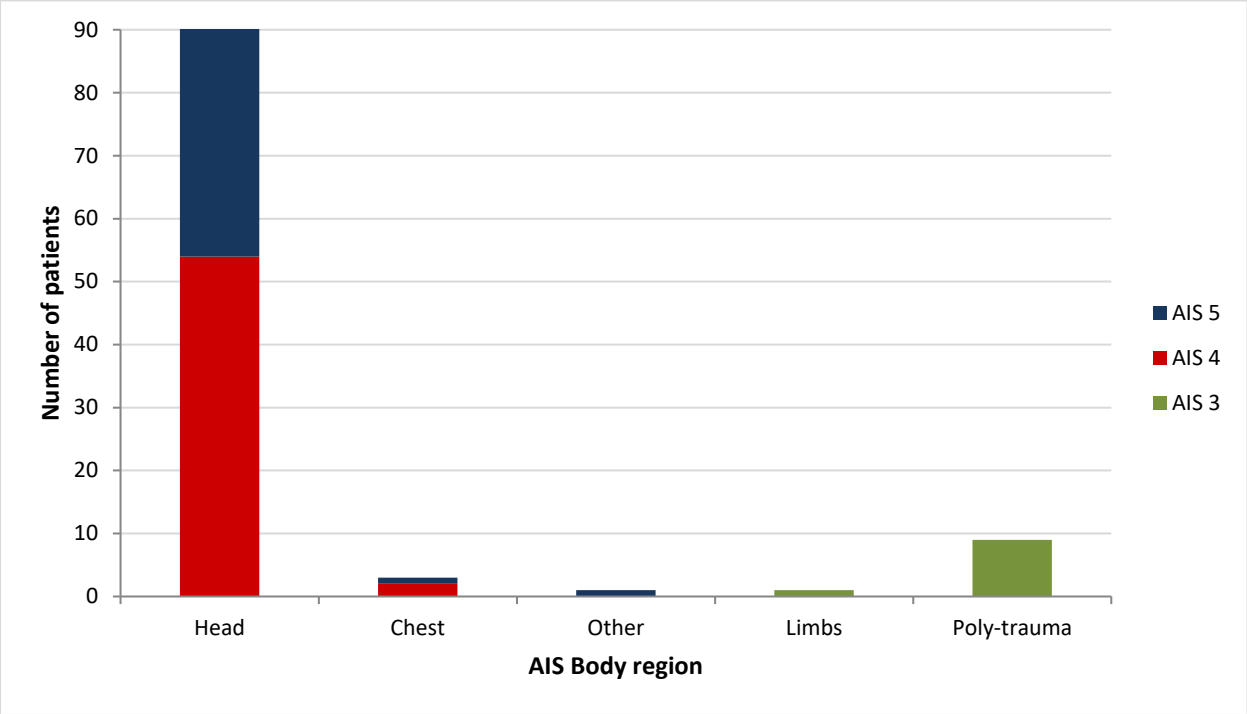
There is a consistent pattern over the years that many severely injured children are not brought to hospital by ambulance or helicopter.

This has a continuing significant implication for the future configuration of paediatric trauma services, as trauma systems must anticipate that nearly a third of patients will continue to arrive (unannounced) at the nearest hospital (which is likely to be a non-specialist Trauma Unit).

* Other includes walk in patients, existing In-patients, those brought in by car and those who are recorded as ‘unknown’. The ‘unknown’ category is seldom used for patients who arrive by ambulance / helicopter and usually represents being brought to hospital by private transport.

2 Years of Severe Injury in Children

Body regions injured following suspected physical abuse for patients not conveyed by ambulance/helicopter (AIS 3+)*



* This includes 'walk in' patients and patients brought in by car.

For this report we have further investigated the type and severity of injury present in children who are conveyed to hospital by private transport. There are surprising numbers of the most severe types of head injury in patients who are brought to hospital by private transport (see example of SPA above). There is a clear need for all TUs to be able to provide immediate care and transfer of children arriving by private (parent) transport unannounced to the 'walk in' entrance of the emergency department with a severe brain injury. This is a scenario which should be covered by a 'standard operating procedure' and regularly rehearsed as a 'drill' (a simulation in the real environment) in all TUs.

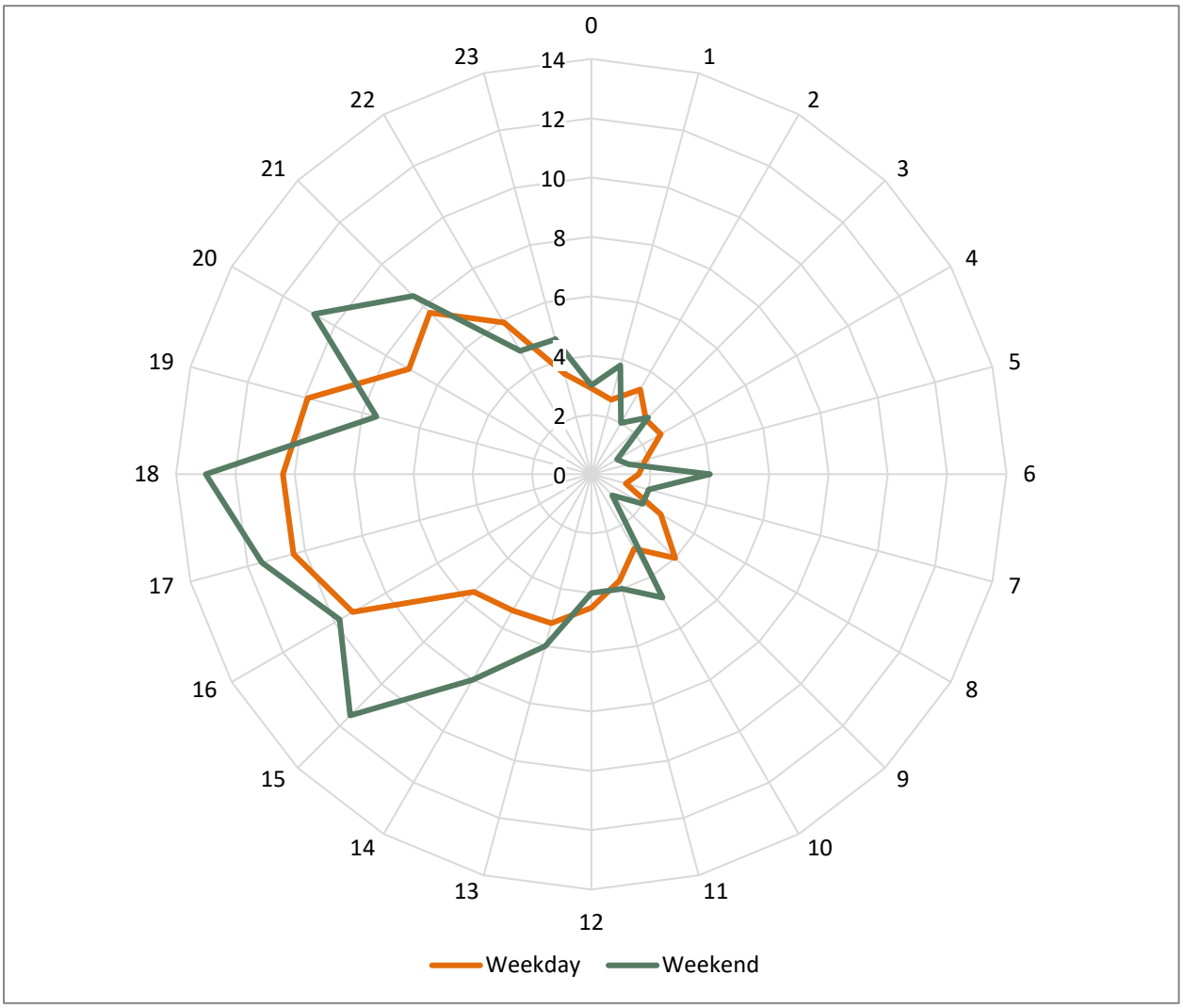
Footnote:

The Abbreviated Injury Scale (AIS) is an internationally recognised method of scoring the level of injury. A value between 1 (minor) and 6 (fatal) is assigned to each injury. An AIS 3 would be defined as a serious injury and would include femur fractures, base of skull fractures and organ contusions. AIS 4 is classed as severe and includes injuries such as lacerations to organs, bleeds to the brain and complicated pelvic fractures. AIS 5 is defined as critical and includes injuries such as major organ rupture or transection.

2 Years of Severe Injury in Children

Arrival at hospital

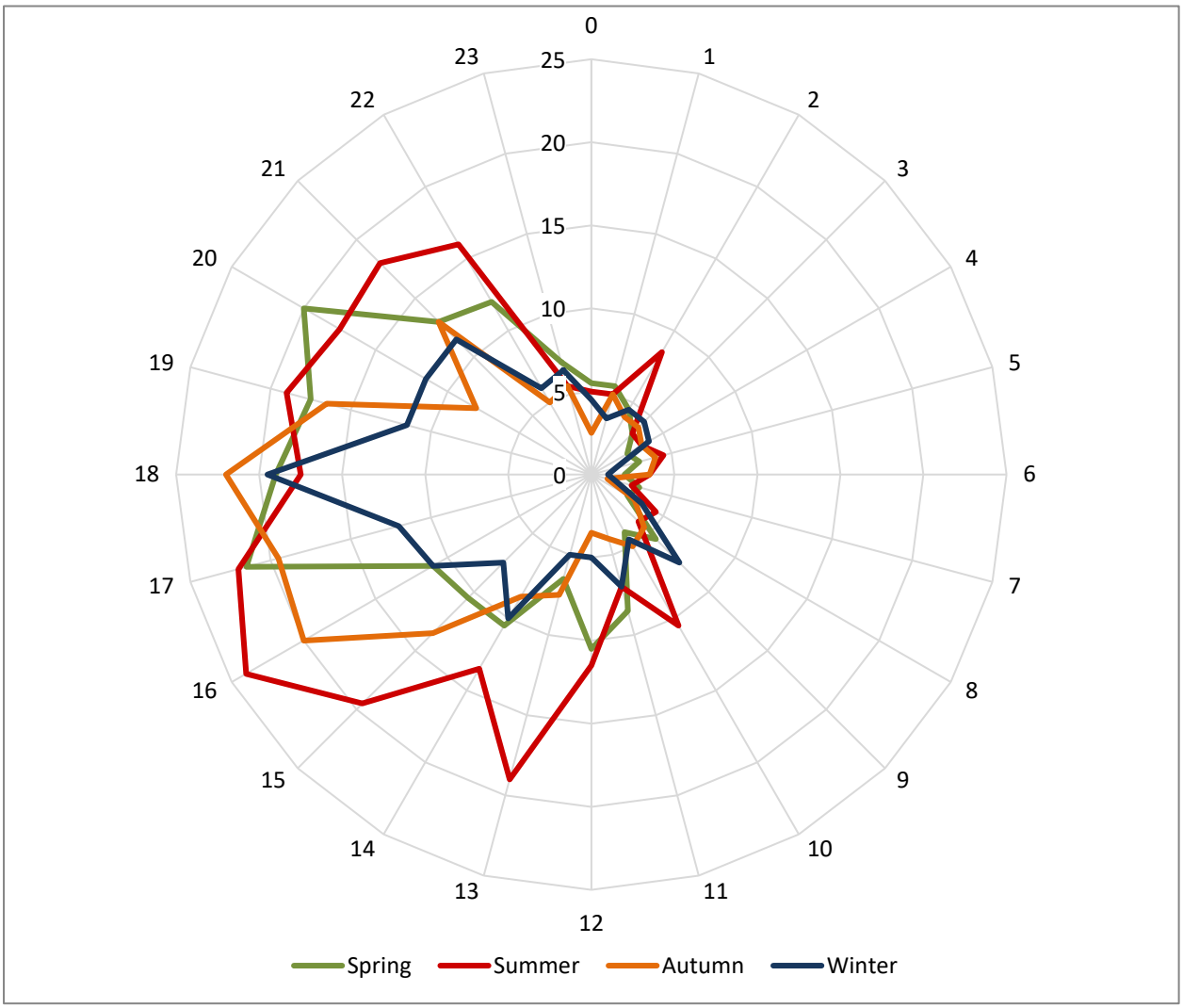
Average number of patients arriving per hour



Severely injured children attend hospital mainly during daytime hours, with a large peak after school. There is a similar pattern at the weekend. This pattern of attendance has an implication for the staffing of paediatric trauma services which need to be geared to receive peak activity ‘out of hours’ in the late afternoon, evening and at weekends. There are a very low number of severe injuries occurring at night. These patterns are similar to previous reports.

2 Years of Severe Injury in Children

Average number of patients arriving per hour, by season

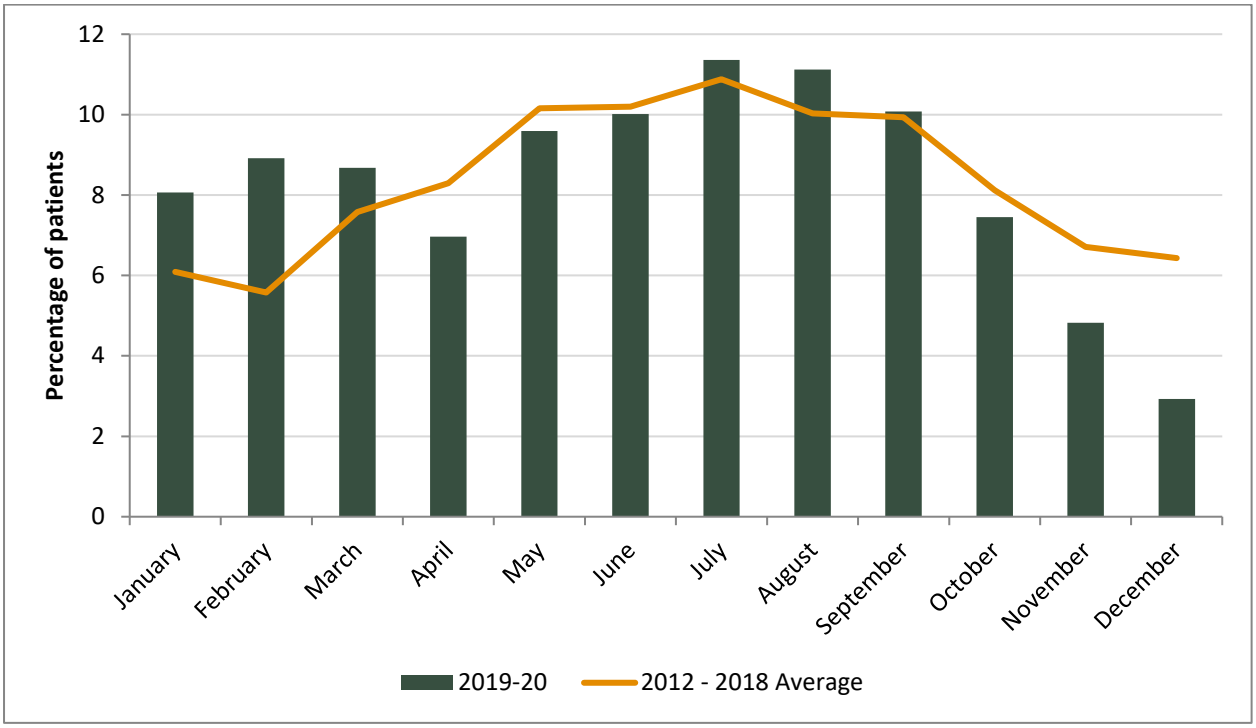


Longer hours of daylight and better weather for outdoor activities probably account for wider spread of time of presentation in the summer.

This graph shows the time of presentation – so time of injury is probably an hour earlier. This might be important if trying to interpret the winter peak at 18:00. This peak was seen to some extent in the 2017/28 report, where it occurred at 16:00 to 18:00. This pattern might relate to darkness occurring soon after finishing school.

2 Years of Severe Injury in Children

Presentation by month

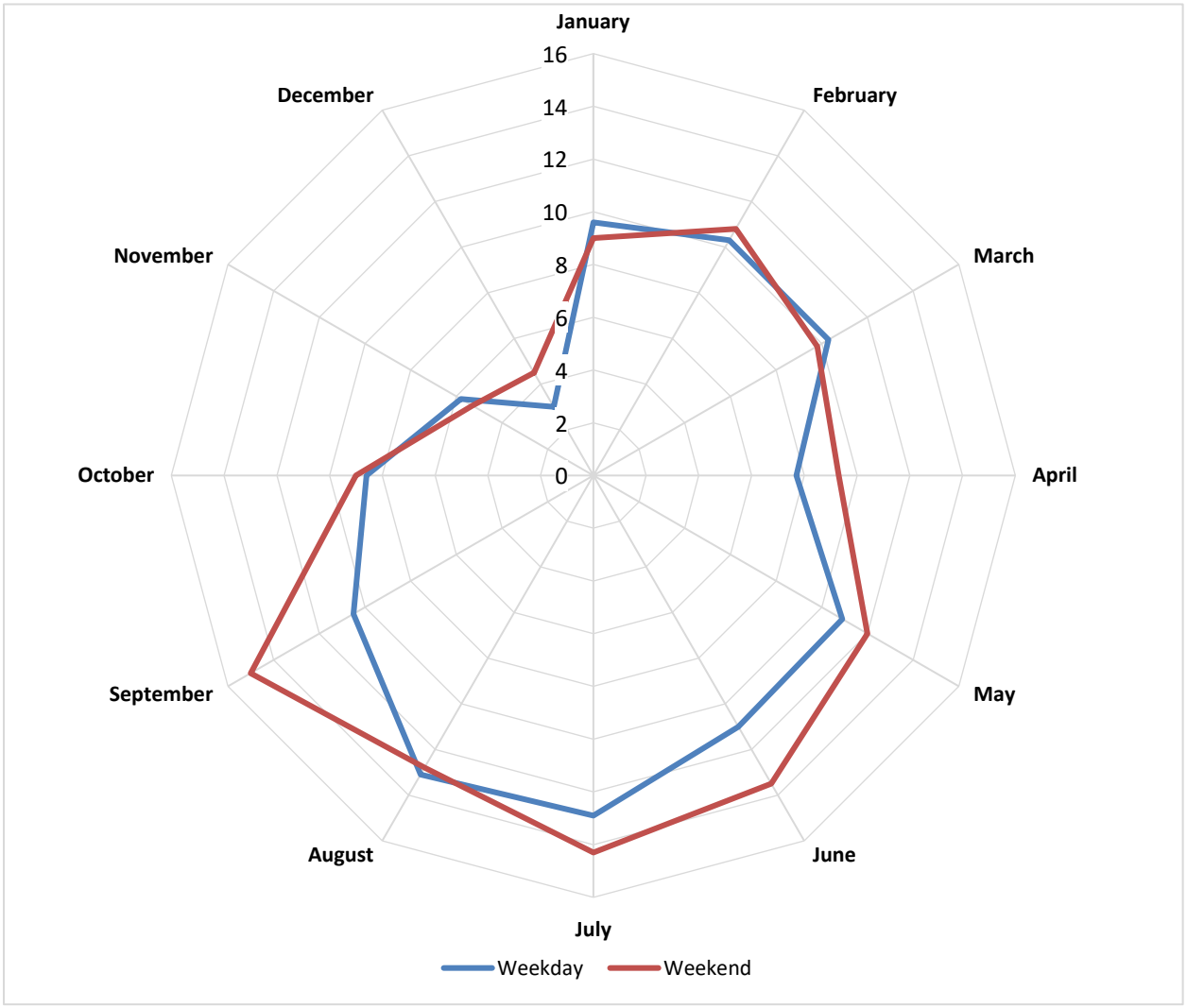


More children present with injury during the summer months, probably linked to outdoor activity with increased length of daylight hours and the long summer school holidays. School is a relatively safe place for children. When the dataset is examined week by week there are noticeable peaks during school holidays (this is a stronger effect when local data is presented, as the national peaks are 'blurred' by variation in school holiday dates across the country).
This pattern seems to be consistent across the years and suggests that paediatric trauma care systems require more staff in summer and school holidays, which may have resource implications.

The 2019-20 lower figure in April may be related to the first Covid19 lockdown 2020 (started 23rd March) and the lower figures for November and December could be related to the second lockdown (started 5th Nov 2020). The impact of the Covid19 pandemic on trauma is being published in detail elsewhere.

2 Years of Severe Injury in Children

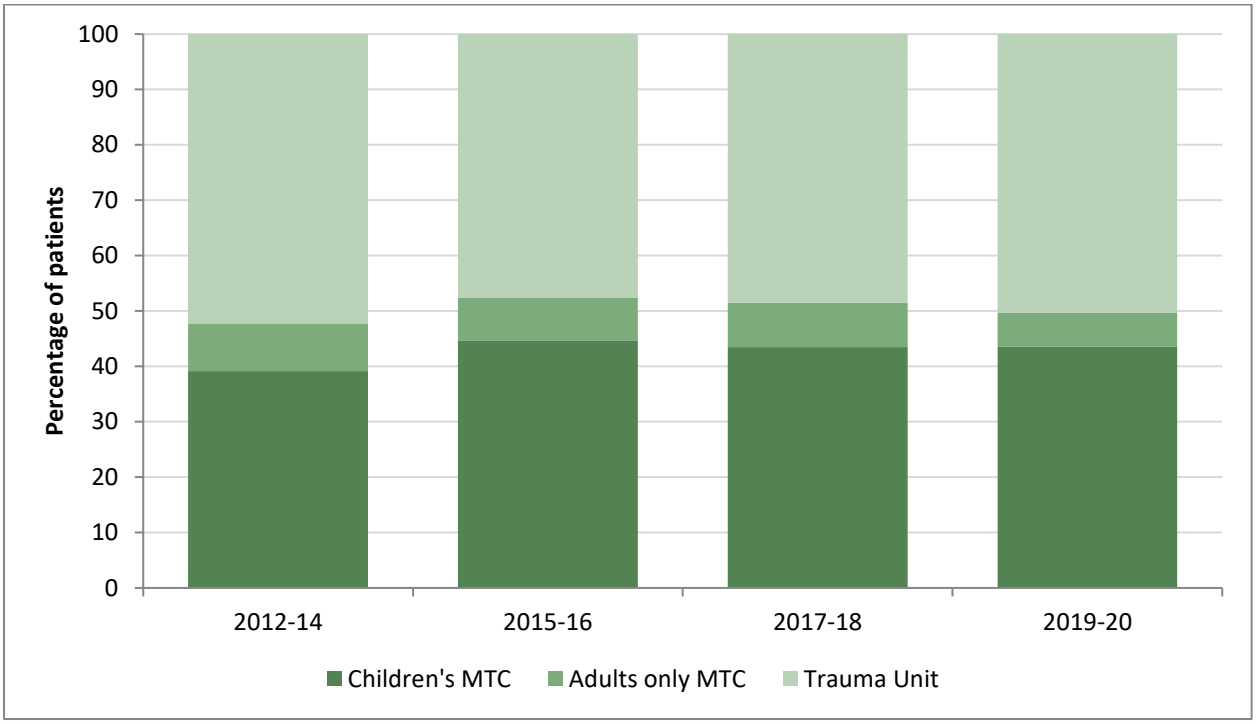
Presentation by day and month



There is little difference between weekday and weekend presentations over the year, suggesting that the availability of staffing and resources for the paediatric trauma care system should be the same at weekends as during the week.

2 Years of Severe Injury in Children

Type of first admitting hospital

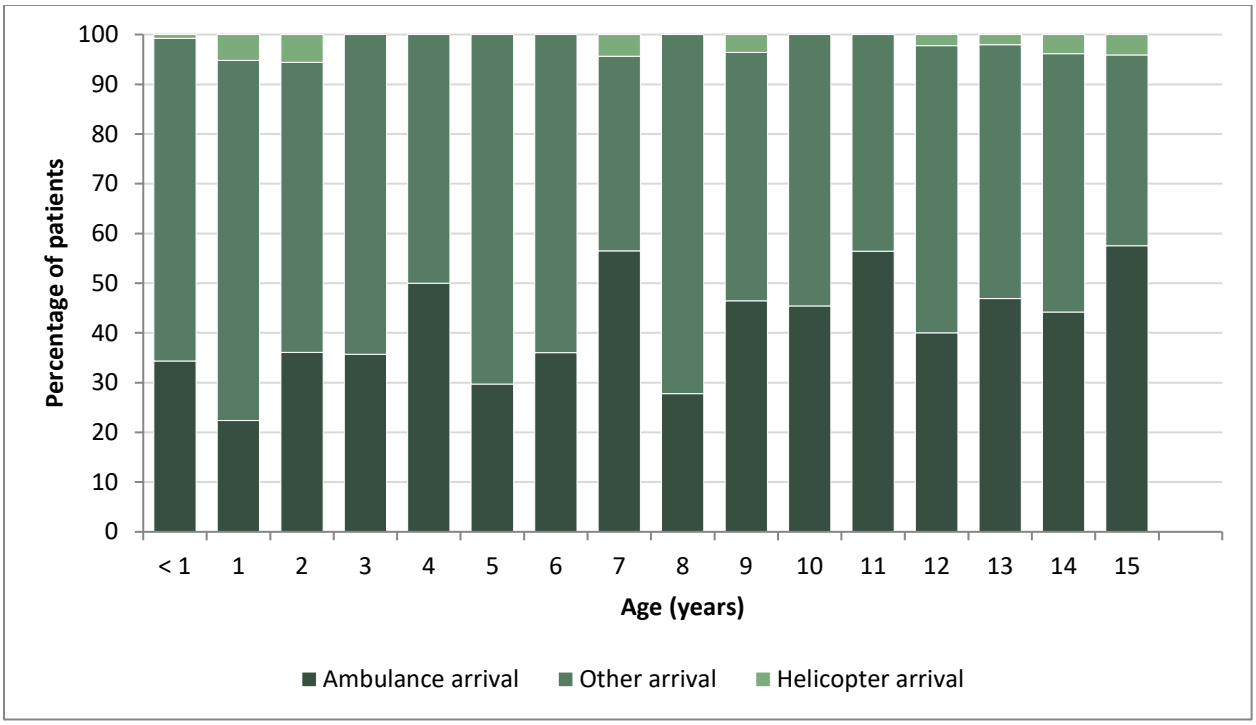


There is a consistent pattern of arrival over time. Just over half of severely injured children are initially treated in a Trauma Unit, with only about 40% being taken to an appropriate specialist centre from the beginning (an Adult-only MTC has not been counted as an appropriate centre - this could be argued either way, but would make relatively little difference to interpretation). Paediatric inter-hospital trauma transfer remains a key function of the wider trauma network, and the efficiency and appropriateness of this system is a key area for future audit.

* First admitting hospital: In some cases details about the first admission site may not have been sent to TARN (better data is received from MTCs than TUs), but the hospital type of first admission can be deduced from the transfer site's notes (e.g. If a patient presented to a TU and was transferred to an MTC, the MTC might identify the first hospital even if the case was not reported from the TU).

2 Years of Severe Injury in Children

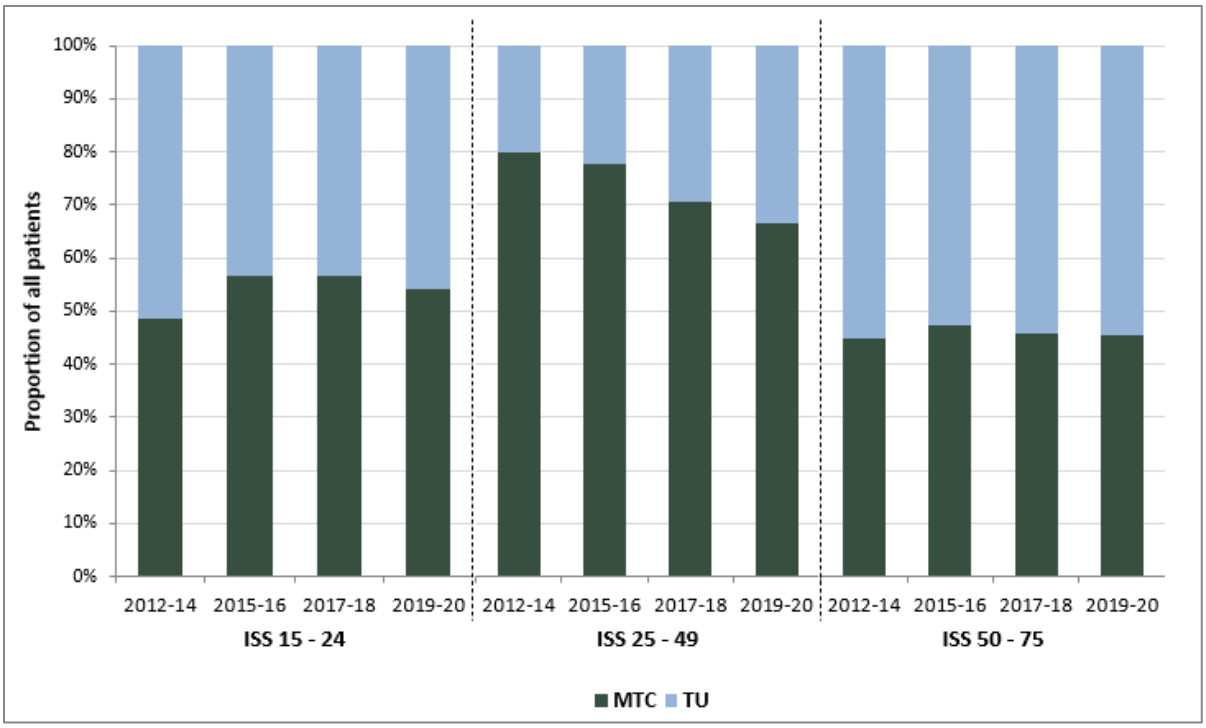
Mode of Arrival of patients initially admitted to a Trauma Unit by Age



The youngest patients (under one year) were the most likely to be admitted to a TU without using an ambulance, probably because babies are easy to carry to hospital by parents / carers, who are likely to go to the nearest hospital, which will likely be a TU. This emphasises the need to provide paediatric skills in Trauma Units in order to undertake initial interventions and resuscitate before and during transfer to a specialist centre. It is a paradox of the current trauma system organisation that the least experienced trauma teams (those in a TU) are most likely to get the most challenging patients. Providing a system that gives experienced trauma resuscitation and decision making in these patients in every TU will need novel solutions.

2 Years of Severe Injury in Children

Patients initially admitted to a MTC or Trauma Unit by ISS



The relationship between injury severity and initial hospital needs further investigation to explain these trends. The most severely injured children (ISS 50 – 75) may have the need for emergency interventions – which may mean that they are taken to the nearest hospital rather than bypassing to a MTC (accounting for the lower proportion of the most severely injured children who have a MTC as their initial hospital).

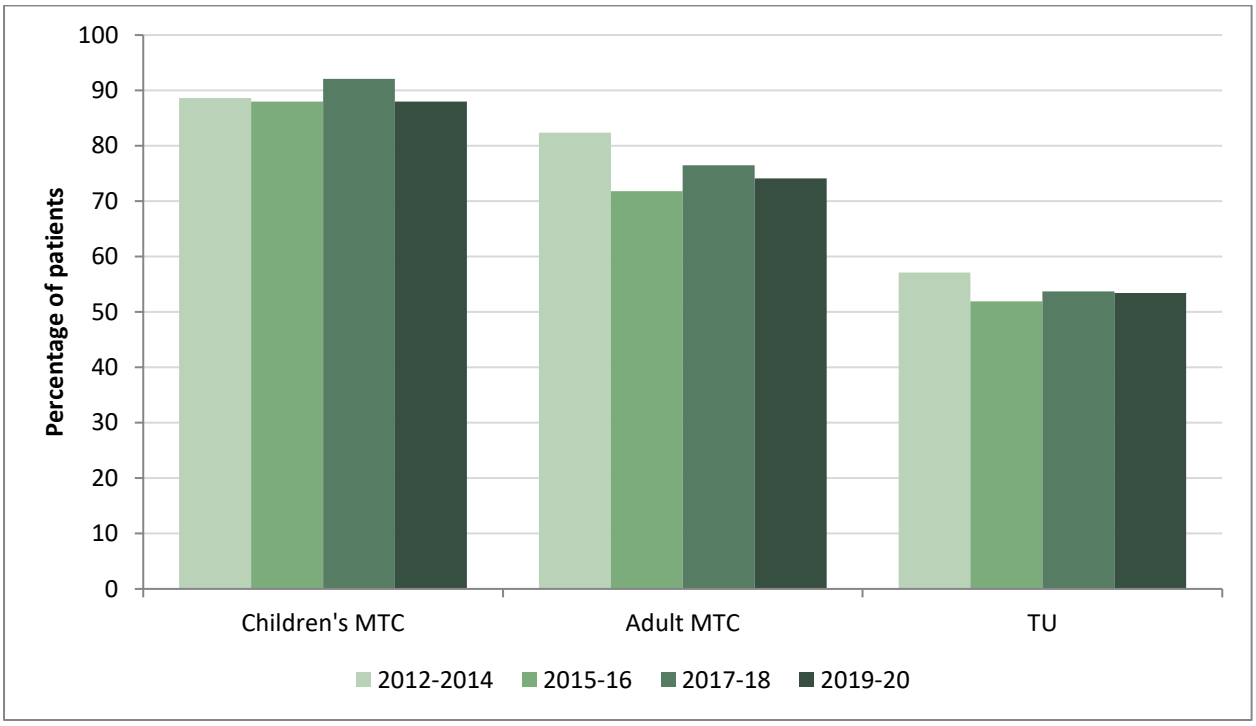
Those with slightly less severe injuries (ISS 25 – 49) may not have a need for immediate intervention and therefore be more likely to be triaged to a MTC.

The injuries with an ISS of 15 – 24 may be more difficult to identify using the prehospital triage tool or may be more likely to be transported by parents / carers (to the nearest hospital).

There are complex potential interactions underlying these results. A greater understanding of patient flow through the trauma system is required as there seems to be the potential to improve care.

2 Years of Severe Injury in Children

Patients seen by a consultant in ED

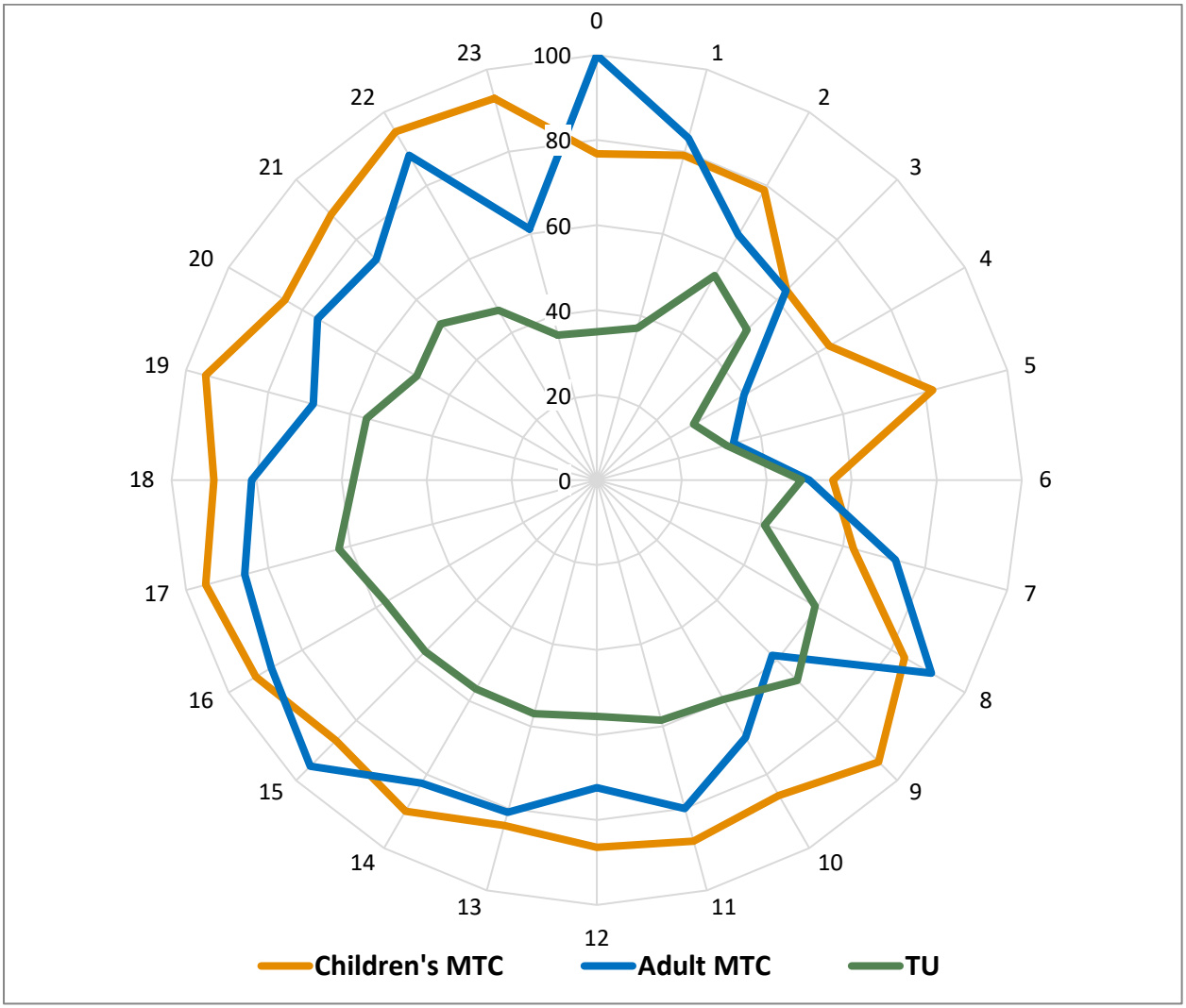


Severely injured children are more likely to have consultant involvement in the ED in a specialist major trauma centre. The overall low level of senior involvement in Trauma Units is worrying in the light of the large number of severely injured children who initially attend a TU and suggests that the current organisation of trauma care might not be providing best care for paediatric major trauma. A case could be made for mandatory consultant involvement (perhaps as part of the regional trauma system) in every TU paediatric trauma call, as the distribution by time of day suggests that this would not be a particularly onerous requirement.

2 Years of Severe Injury in Children

Percentage of patients seen by consultant in ED by time of day

2012 to 2020

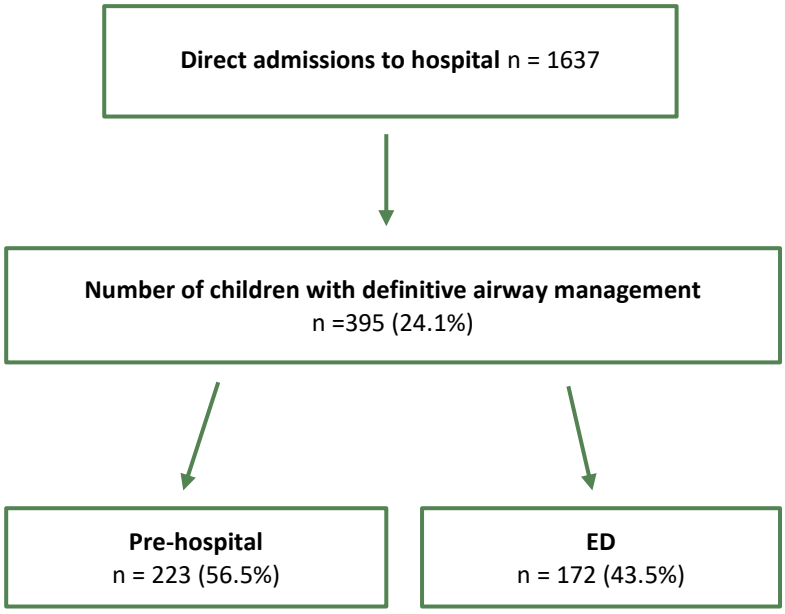


Very few children present with major trauma during the night (as described on page 22), however when this does occur there is less likely to be a consultant present. There are too few presentations at night to look at trends over time.

2 Years of Severe Injury in Children

Definitive airway management

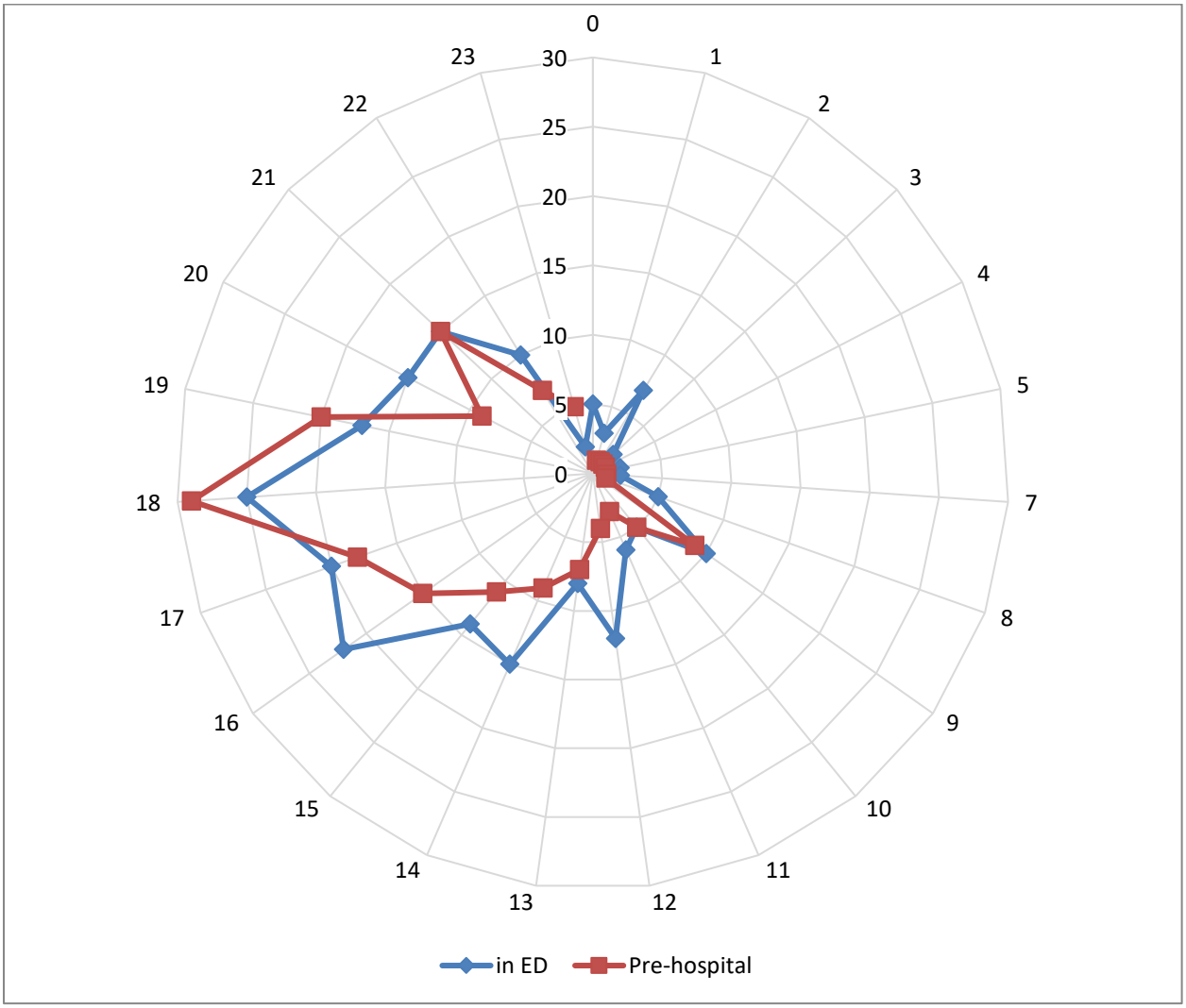
2019-20



Of the 1637 patients with an ISS>15, all had a complete record about intubation. Of the 1637 patients, one third had definitive airway management (intubation, cricothyroidotomy or tracheostomy) at a median of 1.1 hours after injury (IQ range 0.7 to 1.8. Over half of intubations were carried out in the pre-hospital phase.

2 Years of Severe Injury in Children

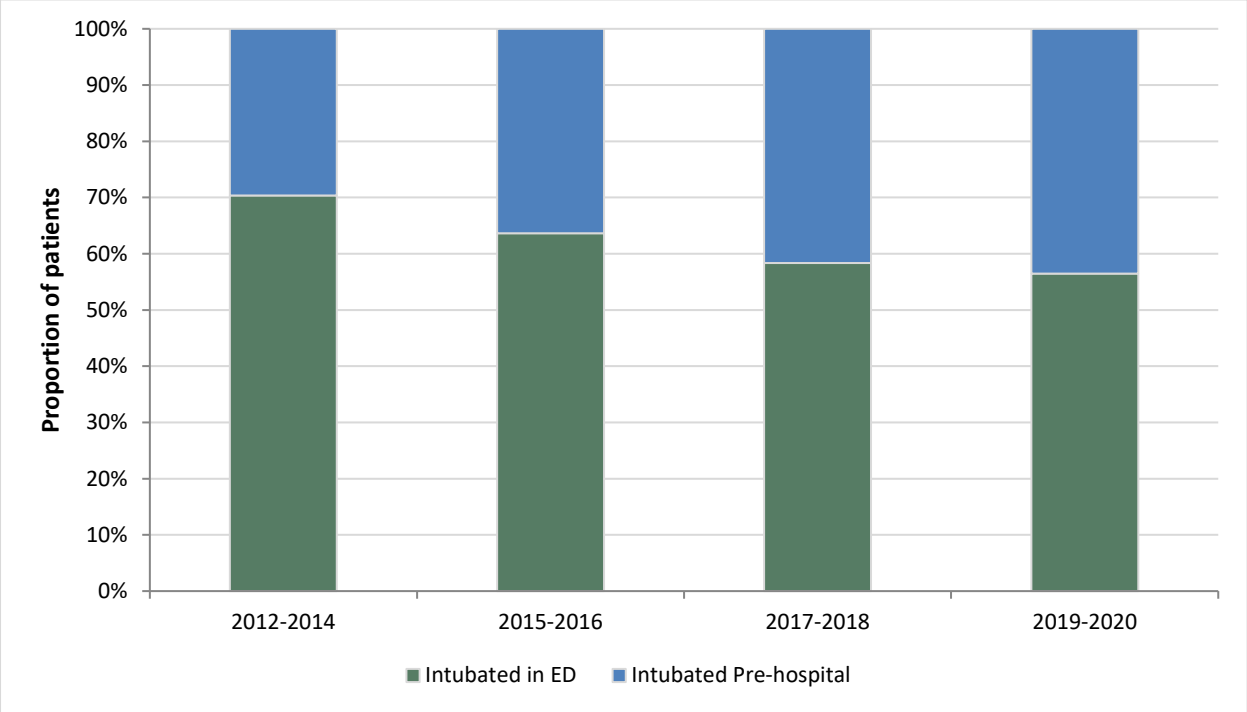
Intubation in ED or Pre-hospital by time of presentation



The resource requirement for definitive airway management is very unevenly spread throughout the day with a large peak in the later afternoon / early evening. This needs further investigation as it is a slightly different pattern (a much sharper peak at 18:00) from the overall 24hr incidence pattern of major trauma in children, but may represent after-school pedestrian / cycling injuries.

2 Years of Severe Injury in Children

Proportion of children intubated in ED and Pre-hospital each year



There is a trend of an increasing proportion of children being intubated in the pre-hospital phase. This probably represents increasing availability of Pre-Hospital Emergency Medicine (PHEM) trained doctors. As the majority of injured children requiring intubation now have this procedure in the prehospital phase the system for training and skill retention for PHEM doctors assumes a greater importance and seems a good area for further audit / research.

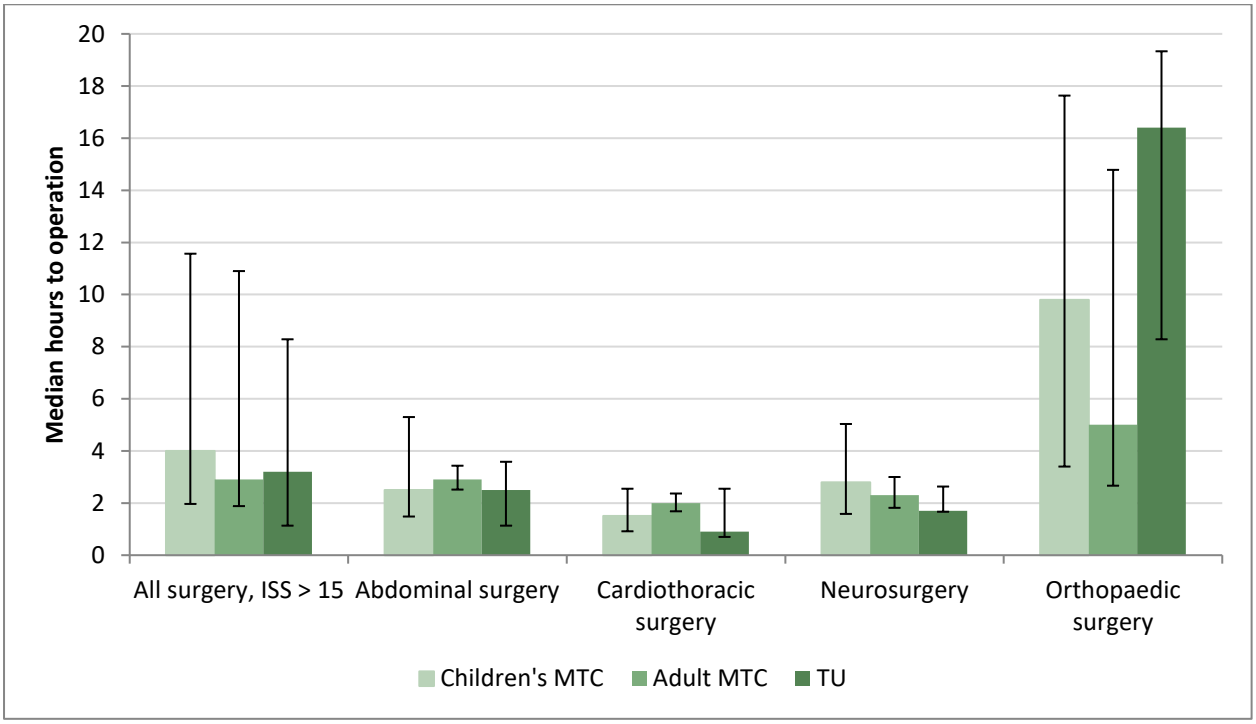
2 Years of Severe Injury in Children

Surgery

Median hours from hospital arrival to first surgery

2012 to 2020

Direct Admissions

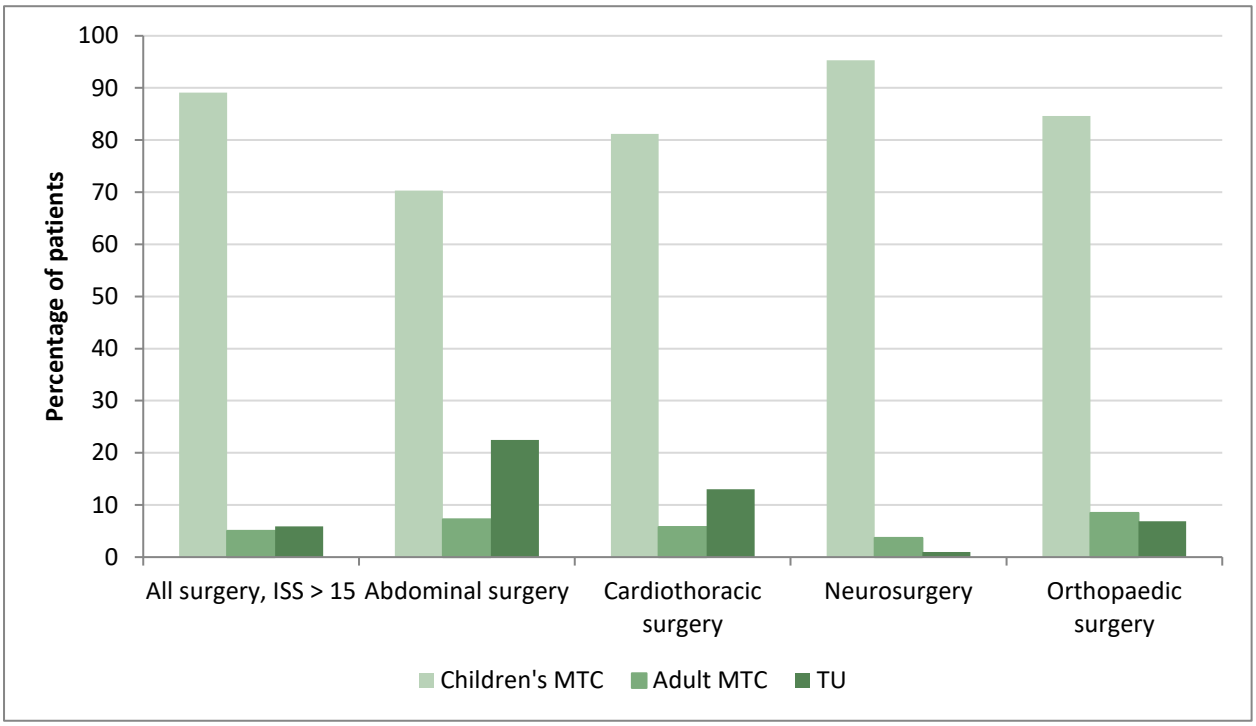


Data on time to surgery shows a greater variation for the specialties (such as orthopaedics) where fewer initial operations are emergencies. As few children require emergency surgery and there is a lot of variation further subdivision of this data would be difficult to interpret. It is difficult to draw any conclusions about the organisation of services from this data.

2 Years of Severe Injury in Children

Location of first surgery

2012 to 2020

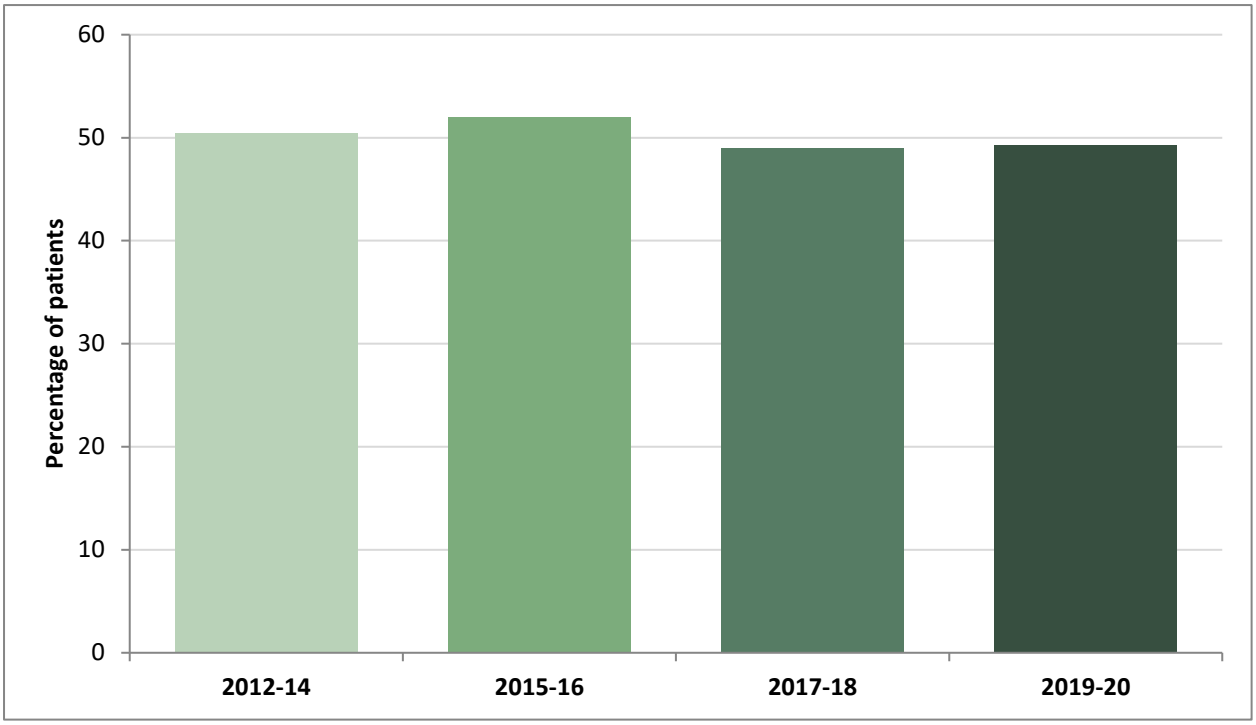


There are some cardiothoracic specialist units which are not co-located with a MTC, which may account for the cardiothoracic operations outside of a MTC.

Most surgery takes place in a Children's MTC, however the appropriateness of surgery (particularly abdominal surgery) taking place in a TU seems to be a good area for further audit / research.

2 Years of Severe Injury in Children

Patients admitted to ICU / HDU



The proportion of children with major trauma requiring admission to intensive care has remained constant since 2012.

2 Years of Severe Injury in Children

Length of stay in hospital

Length of stay	All children	ISS < 15	ISS > 15
Total hospital length of stay (days)	43,390	24,334	19,056
Total length of stay in critical care (days)	4,451	603	3,848

Average length of stay

Length of stay	Median days	Interquartile range (days)
LOS**	6	4 - 10
LOS, patients transferred	6	4 - 11
LOS in ICU/HDU	2	1 - 5
LOS, patients that went to ICU / HDU	7	4 - 17

NHS (England and Wales) bed requirement for patients in TARN dataset:

	All Children	ISS < 15	ISS > 15
Ward beds	119	67	52
Critical care beds	12	1	11

**Length of stay is the calculated from the date of admission to hospital/ICU/HDU to the date of discharge from hospital/ICU/HDU.
This is an underestimate of the total trauma bed requirement as many children with injuries (ie a broken arm) will be admitted for less than 3 days.

There may also be some underestimation, as the complete length of stay for patients treated at more than one hospital may be unknown if one of those hospitals has not submitted data on the patient to TARN. All of these figures are similar to 2012 and 2014 Reports.

2 Years of Severe Injury in Children

Transfers

Transfer from initial hospital of children ISS>15

	Transfer to:			
Initial site	**Adult MTC**	**Children's MTC**	**TU**	**No Transfer**
Adult MTC (n=101)	(0%)	60 (59.4%)	(0%)	41 (40.6%)
Children's MTC (n=713)	3 (0.4%)	21 (2.9%)	28 (3.9%)	661 (92.7%)
TU (n=823)	4 (0.5%)	576 (70.0%)	26 (3.2%)	217 (26.4%)

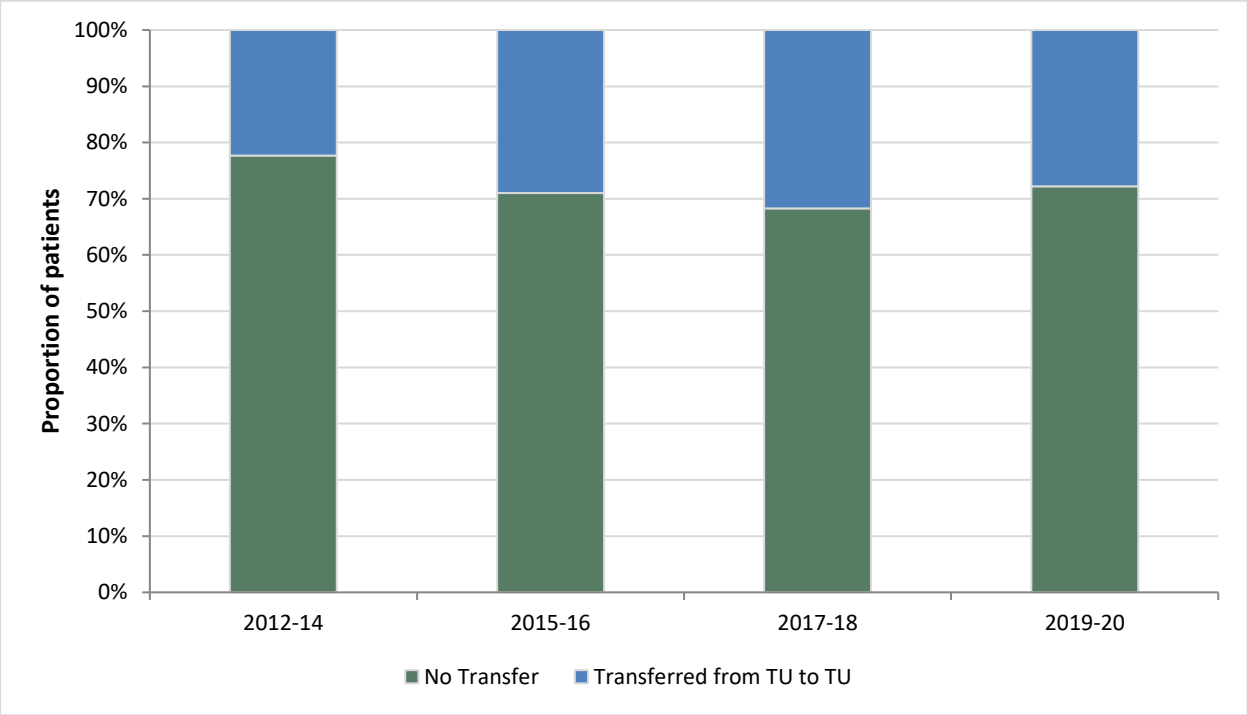
This table represents the inter-hospital transfer activity for ISS>15 patients within the major trauma systems. Not all of the transfers were acute.

2 Years of Severe Injury in Children

Patients remaining in a Trauma Unit

2019-20

(n=374)



Although most severely injured children who are admitted to a non-specialist Trauma Unit are transferred to a specialist centre, it seems surprising that about a third, across all ages, are not transferred to a MTC. These patients either have no transfer or are transferred to another Trauma Unit (which may represent repatriation for rehabilitation nearer home). This has now been a consistent pattern across all four of our reports. This is an area that should be the subject of future investigation, in order to evaluate whether or not an appropriate pathway of care is being followed.

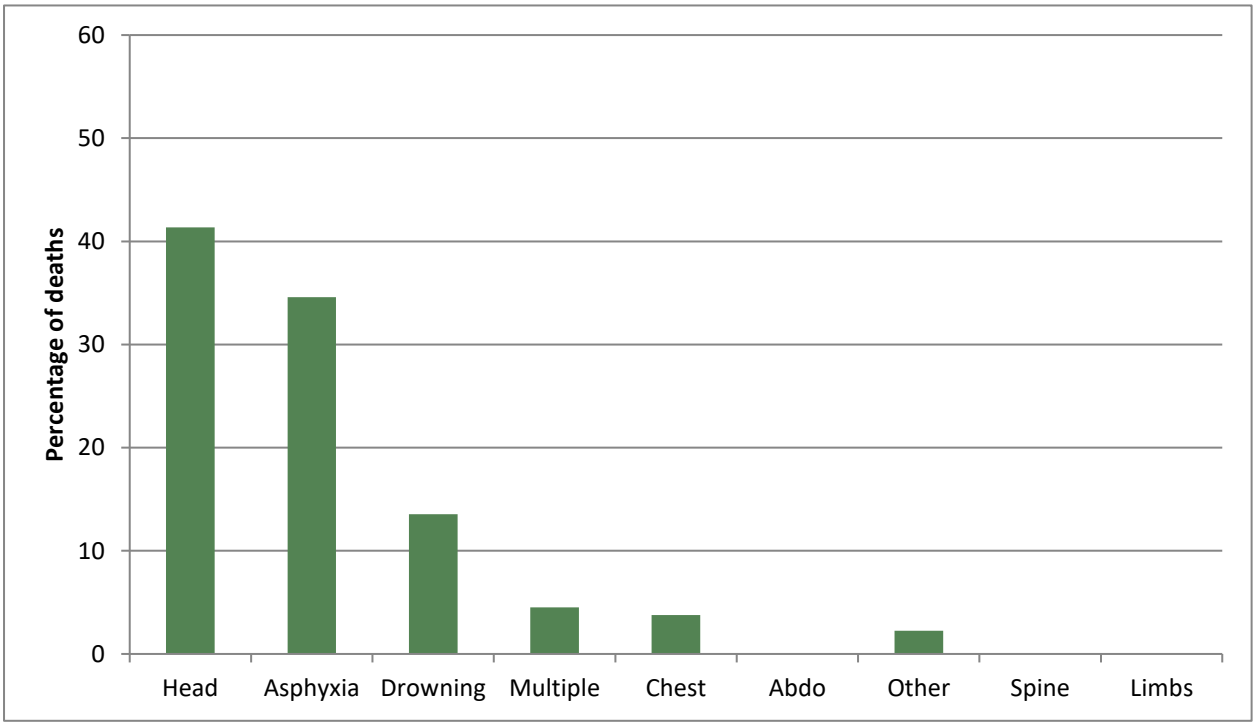
2 Years of Severe Injury in Children

Mortality

Category	Total number of cases ISS>15	Number of deaths	Mortality %	95% confidence interval	
				Lower	Upper
All admissions	1572	133	8.5%	7.1	9.8
All admissions with GCS < 15	604	112	18.5%	15.4	21.6

The crude mortality is similar to previous reports. Final outcome is unknown for 72 of the 1637 (4.4%) patients due to missing data. A more detailed analysis of mortality trends would require a risk adjusted paediatric trauma outcome model.

Deaths by body area with most severe injury



Brain injury remains numerically the most important cause of both severe injury and injury death in childhood. Asphyxia and drowning have a much lower incidence but represent a high proportion of deaths due to the high case fatality rate.

The high proportion of deaths due to asphyxia emphasises importance of mental health services for children, as improvements in treatment systems are unlikely to decrease the number of children dying of asphyxia. In our first report in 2012 asphyxia represented only 12% of deaths in children, which has apparently increased to 35% over 8 years, with a large drop in deaths from chest trauma and multiple injuries. There may be recording differences, but these changes seem worthy of further investigation.

* Other includes injuries such as burns, hypothermia and frostbite.

2 Years of Severe Injury in Children

Interaction of AIS 3+ injuries & associated mortality

	Head	Spine	Chest	Abdomen	Limbs	Pelvis
Head	**60 (5.6%)**					
Spine	11 (25.6%)	**11 (15.9%)**				
Chest	26 (19.8%)	2 (10%)	**33 (9.7%)**			
Abdomen	7 (25%)	1 (9.1%)	6 (5.8%)	**8 (3.2%)**		
Limbs	7 (10.8%)	2 (22.2%)	4 (6.1%)	3 (15.8%)	**7 (5.6%)**	
Pelvis	2 (11.8%)	0 (0%)	2 (7.4%)	0 (0%)	0 (0%)	**2 (3%)**

Values are the number of patients that died (mortality %) within each category i.e. 6 patients with AIS 3+ injuries to the chest and abdomen died representing a case fatality rate of 5.8% for patients in this group. Please note patients may appear in multiple groups. Asphyxia (71% mortality) and drowning (58% mortality) have been excluded from the table as these are usually isolated mechanisms.

Whilst the largest number patients (60) died in the isolated brain injury there was a relatively low case fatality rate in this group (5.6%). In contrast once a head injury was combined with a severe injury to the abdomen, spine or chest, the case fatality rate was much higher (with more than 20% of children with these combinations dying). However there were relatively few patient in the Head / Abdomen group.
Overall this analysis suggests a continuing need for neurosurgical and cardiothoracic services to be well aligned in paediatric trauma services.

Glossary

AIS	Abbreviated Injury Scale score. A value between 1 (minor) and 6 (fatal) is assigned to each injury.
AIS 3+	Injuries with an AIS severity score of 3 or more.
Child	A patient up to the age of 16 years
Definitive Airway Management	Intubation, cricothyroidotomy or tracheostomy.
Direct admissions	Describes care in the first treating hospital.
GCS	Glasgow Coma Scale. A measure of consciousness ranging from 3, indicating complete unconsciousness, to 15, indicating a state of normal alertness. GCS is composed of eye, verbal and motor scores.
HDU	High Dependency Unit
HES	Hospital Episode Statistics. Data collected in hospitals on all admissions. This data is used to produce an expected number of eligible patients that should be submitted to TARN.
ICU	Intensive Care Unit
ISS	Injury Severity Score. A score ranging from 1, (minor) to 75 (severe injuries that are likely to result in death). An ISS between 9 and 15 is considered moderate. An ISS of 16 or more is considered severe. ISS is calculated using the Abbreviated Injury Scale (AIS).
LOS	Length of Stay. Calculated from the date of admission to hospital/ICU/HDU to the date of discharge from hospital/ICU/HDU.
MTC*	Major Trauma Centre. A Major Trauma Centre is a multi-speciality hospital on a single site and provides specialist services to manage all types of serious injuries as well providing consultant-level care.
SPA	Suspected physical abuse. Previously referred to as suspected NAI (Non-Accidental Injury).
Polytrauma	AIS 3+ injuries in more than one body region.
TARN	The Trauma Audit & Research Network.
TARNlet	The TARNlet committee, consisting of clinicians, managers and academics who focus on injured children, was established to address specific questions relating to paediatric trauma care.
TU*	Trauma Unit. A Trauma unit provides care for most injured patients. It has a system in place so that patients with severe injuries can move rapidly to a hospital that can manage their injuries such as a Major Trauma Centre. Some Trauma Units will also provide some specialist services for patients who do not have multiple injuries (such as open tibial fractures).

2 Years of Severe Injury in Children

Grades of Doctor

Consultant	Consultant
Associate Specialist	Associate Specialist
ST3 and above	Specialist registrar, speciality trainee, clinical fellow, senior registrar, staff grade
FY / ST 1-2	FY/ST 1-2
Trust Grade	
Other / Not recorded	Not known / recorded, Nurse Consultant, Advanced Practitioner

*Regional Networks for Major Trauma – advice from NHS Clinical Advisory Group on Trauma

2 Years of Severe Injury in Children

Appendix: Data tables and figures

Table 1: Demographics of severely injured children (n=1637)

Age (Years)	Number of severely injured children (%)
age < 1	385 (23.5%)
1	95 (5.8%)
2	72 (4.4%)
3	74 (4.5%)
4	55 (3.4%)
5	63 (3.8%)
6	57 (3.5%)
7	55 (3.4%)
8	44 (2.7%)
9	52 (3.2%)
10	55 (3.4%)
11	89 (5.4%)
12	99 (6%)
13	127 (7.8%)
14	127 (7.8%)
15	188 (11.5%)
Medians Age, ISS and gender split	
Median Age (IQR)	7.3 (1.1 - 13.3)
Median ISS (IQR)	22 (16.0 - 26.0)
Male (percentage)	67.5%
Female (percentage)	32.5%

Table 2: Patients aged under 1 year old (n=385)

Age (Months)	Number of severely injured children (%)
age < 1	39 (10.1%)
1	67 (17.4%)
2	47 (12.2%)
3	39 (10.1%)
4	42 (10.9%)
5	24 (6.2%)
6	22 (5.7%)
7	23 (6%)
8	24 (6.2%)
9	19 (4.9%)
10	17 (4.4%)
11	22 (5.7%)

Table 3: Injury mechanism – all patients

Category	2012-14	2015-16	2017-18	2019-20
Road Traffic Collision	944 (41.1%)	654 (39.7%)	646 (36.2%)	563 (34.4%)
Fall < 2m	469 (20.4%)	382 (23.2%)	388 (21.7%)	379 (23.2%)
Fall > 2m	280 (12.2%)	165 (10%)	216 (12.1%)	184 (11.2%)
SPA under 2 years	228 (9.9%)	189 (11.5%)	236 (13.2%)	216 (13.2%)
Blunt assault	180 (7.8%)	149 (9%)	166 (9.3%)	148 (9%)
Other (eg. sport)	69 (3%)	33 (2%)	40 (2.2%)	45 (2.7%)
Asphyxia	53 (2.3%)	34 (2.1%)	41 (2.3%)	53 (3.2%)
Drowning	56 (2.4%)	23 (1.4%)	35 (2%)	30 (1.8%)
Penetrating	16 (0.7%)	19 (1.2%)	18 (1%)	19 (1.2%)

Table 4: Injury mechanism – fatalities (case with known outcome only)

Category	2012-14	2015-16	2017-18	2019-20
Road Traffic Collision	75 (36.2%)	54 (42.9%)	37 (28.2%)	34 (25.6%)
Fall < 2m	8 (3.9%)	3 (2.4%)	3 (2.3%)	2 (1.5%)
Fall > 2m	7 (3.4%)	5 (4%)	8 (6.1%)	5 (3.8%)
SPA under 2 years	21 (10.1%)	9 (7.1%)	18 (13.7%)	16 (12%)
Blunt assault	15 (7.2%)	9 (7.1%)	10 (7.6%)	8 (6%)
Other (eg. sport)	9 (4.3%)	1 (0.8%)	8 (6.1%)	3 (2.3%)
Asphyxia	40 (19.3%)	27 (21.4%)	31 (23.7%)	46 (34.6%)
Drowning	29 (14%)	14 (11.1%)	13 (9.9%)	18 (13.5%)
Penetrating	3 (1.4%)	4 (3.2%)	3 (2.3%)	1 (0.8%)

Table 5: Case fatality rate by injury mechanism (case with known outcome only)

Category	2012-14	2015-16	2017-18	2019-20
Road Traffic Collision	75 (8.9%)	54 (8.6%)	37 (5.9%)	34 (6.1%)
Fall < 2m	8 (1.9%)	3 (0.8%)	3 (0.8%)	2 (0.6%)
Fall > 2m	7 (2.8%)	5 (3.3%)	8 (3.9%)	5 (2.8%)
SPA under 2 years	21 (10.8%)	9 (5.6%)	18 (8.6%)	16 (8.2%)
Blunt assault	15 (9.5%)	9 (6.3%)	10 (6.3%)	8 (5.6%)
Other (eg. sport)	9 (15.5%)	1 (3.6%)	8 (22.9%)	3 (7.9%)
Asphyxia	40 (76.9%)	27 (71.1%)	31 (68.9%)	46 (80.7%)
Drowning	29 (50%)	14 (56%)	13 (38.2%)	18 (54.5%)
Penetrating	3 (23.1%)	4 (21.1%)	3 (16.7%)	1 (5.6%)

Table 6: Patients injured in a road traffic incident

Category	2012-14	2015-16	2017-18	2019-20
Pedestrian	473 (50.1%)	308 (47%)	296 (45.8%)	220 (39.1%)
Cyclist	225 (23.8%)	165 (25.2%)	174 (26.9%)	183 (32.5%)
Vehicle occupant	190 (20.1%)	145 (22.1%)	122 (18.9%)	110 (19.5%)
Motorcyclist/Quad biker	46 (4.9%)	32 (4.9%)	43 (6.7%)	49 (8.7%)
Not Known	10 (1.1%)	5 (0.8%)	11 (1.7%)	1 (0.2%)

Table 7: Proportion road traffic deaths by type of incident (case with known outcome only)

Category	2012-14	2015-16	2017-18	2019-20
Pedestrian	37 (49.3%)	36 (66.7%)	21 (56.8%)	17 (50%)
Cyclist	15 (20%)	6 (11.1%)	4 (10.8%)	9 (26.5%)
Vehicle occupant	21 (28%)	12 (22.2%)	11 (29.7%)	8 (23.5%)
Motorcyclist/Quad biker	2 (2.7%)	0 (0%)	1 (2.7%)	0 (0%)
Not Known	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 8: Mortality of patients injured in a road traffic incident (cases with known outcome only)

Category	2012-14	2015-16	2017-18	2019-20
Pedestrian	37 (8.7%)	36 (12.2%)	21 (7.3%)	17 (7.9%)
Cyclist	15 (7.5%)	6 (3.8%)	4 (2.4%)	9 (5%)
Vehicle occupant	21 (12.1%)	12 (8.7%)	11 (9.2%)	8 (7.3%)
Motorcyclist/Quad biker	2 (5.3%)	0 (0%)	1 (2.4%)	0 (0%)
Not Known	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 9: Counts of stabbing by age and gender

Age band	Male	Female
< 1	1	
2		1
5		1
6		1
7		2
11		1
13	1	
14	8	2
15	13	

Table 10: Counts of stabbing by age and period

Period	Total
2012-14	14
2015-16	25
2017-18	30
2019-20	31

Table 11: Patients suspected of self-harm, by mechanism

Period	Asphyxia	Fall > 2m	Road Traffic Collision	Shooting	Other (eg. sport)	Blow(s)	Grand Total
2012-14	23 (53.5%)	14 (32.6%)	4 (9.3%)	2 (4.7%)	(0%)	(0%)	43
2015-16	22 (59.5%)	12 (32.4%)	3 (8.1%)	(0%)	(0%)	(0%)	37
2017-18	29 (64.4%)	13 (28.9%)	1 (2.2%)	2 (4.4%)	(0%)	(0%)	45
2019-20	25 (54.3%)	16 (34.8%)	1 (0%)	(0%)	1 (2.2%)	3 (6.5%)	46

Table 12: Patients suspected of self-harm, by month

Month	Year			
	2012-14	2015-16	2017-18	2019-20
January	6 (14%)	2 (5.4%)	6 (13.3%)	6 (13%)
February	1 (2.3%)	3 (8.1%)	3 (6.7%)	5 (10.9%)
March	2 (4.7%)	4 (10.8%)	2 (4.4%)	5 (10.9%)
April	5 (11.6%)	3 (8.1%)	4 (8.9%)	1 (2.2%)
May	3 (7%)	7 (18.9%)	6 (13.3%)	8 (17.4%)
June	5 (11.6%)	3 (8.1%)	5 (11.1%)	3 (6.5%)
July	3 (7%)	3 (8.1%)	0 (0%)	4 (8.7%)
August	2 (4.7%)	3 (8.1%)	3 (6.7%)	1 (2.2%)
September	6 (14%)	0 (0%)	8 (17.8%)	7 (15.2%)
October	2 (4.7%)	2 (5.4%)	3 (6.7%)	2 (4.3%)
November	3 (7%)	4 (10.8%)	1 (2.2%)	3 (6.5%)
December	5 (11.6%)	3 (8.1%)	4 (8.9%)	1 (2.2%)

Table 13: Injury type (AIS 3+)

Anatomical injury location	Number of patients with this injury (%)
3+ Head Injury	1127 (68.8%)
3+ Thoracic Injury	355 (21.7%)
3+ Abdominal Injury	253 (15.5%)
3+ Limb / Pelvis Injury	184 (11.2%)
Polytrauma	127 (7.8%)
3+ Spinal Injury	75 (4.6%)

2 Years of Severe Injury in Children

Table 14: Average number of patients arriving per hour

Hour	Weekday	Weekend
0	2.9	3
1	2.6	3.8
2	3.3	2
3	2.6	2.7
4	2.7	1
5	1.9	1.3
6	1.6	4
7	1.2	2
8	2.7	2
9	4	1
10	2.9	4.8
11	3.7	4
12	4.5	4
13	5.2	6
14	5.3	8
15	5.6	11.5
16	9.3	9.8
17	10.4	11.5
18	10.4	13
19	9.9	7.5
20	7.1	10.8
21	7.7	8.5
22	5.9	4.8
23	3.5	4.7

2 Years of Severe Injury in Children

Table 15: Average number of patients arriving per hour, by season

Hour	Spring	Summer	Autumn	Winter
0	5.5	5	2.5	4.5
1	5.5	5	5	3.5
2	4.5	8.5	4	4.5
3	3.5	3.5	4	4.5
4	2.5	3.5	3.5	4
5	3	4.5	4	1.5
6	2	3.5	3.5	1
7	3	2.5	1	1.5
8	2.5	4.5	3	3.5
9	5.5	4	4.5	7.5
10	4	10.5	5	4.5
11	8.5	7	4	7
12	10.5	11.5	3.5	5
13	6.5	19	7.5	5
14	10.5	13.5	8.5	10
15	10.5	19.5	13.5	7.5
16	11	24	20	11
17	21.5	22	19.5	12
18	19	17.5	22	19.5
19	17.5	19	16.5	11.5
20	20	17.5	8	11.5
21	13	18	13	11.5
22	12	16	5	6
23	7	5.5	5.5	6.5

Table 16: Average number of patients arriving per hour, by month

Month	Number of severely injured children (%)
January	132 (8.1%)
February	146 (8.9%)
March	142 (8.7%)
April	114 (7%)
May	157 (9.6%)
June	164 (10%)
July	186 (11.4%)
August	182 (11.1%)
September	165 (10.1%)
October	122 (7.5%)
November	79 (4.8%)
December	48 (2.9%)

Table 17: Mode of arrival to hospital (direct admissions)

Arrival mode	2012-14	2015-16	2017-18	2019-20
Ambulance	992 (56.2%)	797 (58.9%)	891 (59.5%)	746 (56.4%)
Helicopter	298 (16.9%)	213 (15.7%)	222 (14.8%)	198 (15%)
Other*	474 (26.9%)	344 (25.4%)	385 (25.7%)	378 (28.6%)

Table 18: AIS Body region and severity of patients not conveyed by ambulance/helicopter

AIS body region	AIS 5	AIS 4	AIS 3
Head	56	54	
Chest	1	2	
Other	1		
Limbs			1
Poly-trauma			9

Table 19: Type of first admitting hospital

Year	Children's MTC	Adults only MTC	Trauma Unit
2012-14	39.13%	8.5%	52.37%
2015-16	44.69%	7.77%	47.54%
2017-18	43.51%	7.95%	48.54%
2019-20	43.56%	6.17%	50.27%

Table 20: Trauma unit patients by Age, and arrival mode

Age	TU	Ambulance	Helicopter	Other
< 1	268	92	2	174
1	58	13	3	42
2	36	13	2	21
3	28	10	0	18
4	22	11	0	11
5	37	11	0	26
6	25	9	0	16
7	23	13	1	9
8	18	5	0	13
9	28	13	1	14
10	22	10	0	12
11	39	22	0	17
12	45	18	1	26
13	49	23	1	25
14	52	23	2	27
15	73	42	3	28

Table 21: Patients initially admitted to a MTC or Trauma Unit by ISS

ISS band	Period	MTC	TU
15 to 24	2012-14	517 (45%)	632 (55%)
	2015-16	399 (47%)	445 (53%)
	2017-18	420 (46%)	499 (54%)
	2019-20	386 (45%)	464 (55%)
25 to 49	2012-14	528 (49%)	558 (51%)
	2015-16	430 (57%)	328 (43%)
	2017-18	463 (57%)	353 (43%)
	2019-20	414 (54%)	352 (46%)
50 to 75	2012-14	48 (80%)	12 (20%)
	2015-16	35 (78%)	10 (22%)
	2017-18	36 (71%)	15 (29%)
	2019-20	14 (67%)	7 (33%)

Table 22: Patients initially admitted to a Trauma Unit.

Period	TU to Adult MTC	TU to Children's MTC	No Transfer	TU to TU	Grand Total
2012-14	10	847	268	77	1202
2015-16	6	526	213	87	832
2017-18	6	523	271	126	926
2019-20	4	501	270	104	879

Table 23: Patients admitted to ICU / HDU

Year	Admitted to ICU /HDU (%)
2012-14	1158 (50.5%)
2015-16	856 (52%)
2017-18	874 (48.9%)
2019-20	806 (49.2%)

Table 24: Most senior doctor in ED (direct admissions only)

Most senior in ED	Number of cases (%)			
	All	Children's MTC	TU	Adult MTC
Consultant	968 (73.2%)	624 (47.2%)	284 (21.5%)	60 (4.5%)
Associate Specialist	9 (0.7%)	1 (0.1%)	7 (0.5%)	1 (0.1%)
ST 3+	189 (14.3%)	46 (3.5%)	133 (10.1%)	10 (0.8%)
FY / ST 1-2	44 (3.3%)	3 (0.2%)	37 (2.8%)	4 (0.3%)
Other/Not recorded	112 (8.5%)	35 (2.6%)	71 (5.4%)	6 (0.5%)
Total	**1322**	**709**	**532**	**81**

Table 25: Proportion of children intubated in ED and Pre-hospital each year

Year	Intubated in ED	Intubated Pre-hospital
2012-14	472 (70.3%)	199 (29.7%)
2015-16	287 (63.6%)	164 (36.4%)
2017-18	286 (58.4%)	204 (41.6%)
2019-20	223 (56.5%)	172 (43.5%)

Table 26: Time of proportion of patients with definitive airway management

Hour of Intubation	Pre-hospital	ED
0	5	0
1	3	1
2	7	1
3	2	1
4	1	1
5	2	0
6	0	0
7	2	1
8	5	1
9	10	9
10	5	5
11	6	3
12	12	4
13	8	7
14	15	9
15	14	11
16	22	15
17	20	18
18	25	29
19	17	20
20	15	9
21	15	15
22	10	7
23	2	5
Total	**223**	**172**

Table 27: Mortality by most severe injury

Most severe injury	Deaths (%)
Head	55 (41.4%)
Asphyxia	46 (34.6%)
Drowning	18 (13.5%)
Multiple	6 (4.5%)
Chest	5 (3.8%)
Abdo	0 (0%)
Other	3 (2.3%)
Spine	0 (0%)
Limbs	0 (0%)

Table 28: Patients seen by a consultant in ED

Category	2012-14	2015-16	2017-18	2019-20
Children's MTC	776 (88.6%)	644 (88%)	715 (92.1%)	624 (88%)
Adult MTC	140 (82.4%)	79 (71.8%)	91 (76.5%)	60 (74.1%)
TU	410 (57.1%)	265 (51.9%)	323 (53.7%)	284 (53.4%)

Table 29: Location of first surgery

Category	Total	Children's MTC	Adult MTC	TU
All surgery, ISS > 15	1074	957 (89.1%)	54 (5%)	63 (5.9%)
Abdominal surgery	138	97 (70.3%)	10 (7.2%)	31 (22.5%)
Cardiothoracic surgery	69	56 (81.2%)	4 (5.8%)	9 (13%)
Neurosurgery	512	488 (95.3%)	19 (3.7%)	5 (1%)
Orthopaedic surgery	247	209 (84.6%)	21 (8.5%)	17 (6.9%)

Table 30: Median hours from hospital arrival to first operation (IQR)

Category	Total	Children's MTC	Adult MTC	TU
All surgery, ISS > 15	1074	4 (1.97 - 11.57)	2.9 (1.88 - 10.9)	3.2 (1.13 - 8.28)
Abdominal surgery	138	2.5 (1.48 - 5.3)	2.9 (2.52 - 3.43)	2.5 (1.13 - 3.58)
Cardiothoracic surgery	69	1.5 (0.92 - 2.55)	2 (1.68 - 2.37)	0.9 (0.7 - 2.55)
Neurosurgery	512	2.8 (1.58 - 5.03)	2.3 (1.82 - 3)	1.7 (1.67 - 2.63)
Orthopaedic surgery	247	9.8 (3.4 - 17.63)	5 (2.67 - 14.78)	16.4 (8.28 - 19.33)