



MAJOR TRAUMA AUDIT

National Report 2016







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NOCA was established in 2012 to create sustainable clinical audit programmes at national level. NOCA is funded by the Health Service Executive Quality Improvement Division and operationally supported by the Royal College of Surgeons in Ireland.

The National Clinical Effectiveness Committee (NCEC, 2015, p.2) defines national clinical audit as "a cyclical process that aims to improve patient care and outcomes by systematic, structured review and evaluation of clinical care against explicit clinical standards on a national basis". NOCA supports hospitals to learn from their audit cycles.

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NATIONAL CLINICAL EFFECTIVENESS COMMITTEE (NCEC)



Major Trauma Audit NCEC National Clinical Audit No. 1 The National Clinical Effectiveness Committee (NCEC) is a Ministerial committee of key stakeholders in patient safety and clinical effectiveness. Its mission is to provide a framework for endorsement of guidelines and audit to optimise patient and service user care. The NCEC's remit is to establish and implement processes for the prioritisation and quality assurance of clinical guidelines and clinical audit and subsequently recommend them to the Minister for Health for endorsement and mandating for national implementation.

ACKNOWLEDGMENTS

NOCA would like to acknowledge the valuable contribution of all participating hospitals, as well as the MTA data coordinators and clinical leads. Without their continued support and input, this audit could not continue to produce meaningful analysis of trauma care in Ireland.



NOCA has engaged the internationally recognised Trauma Audit and Research Network (TARN) to provide its methodological approach for MTA in Ireland. TARN has been in operation in the UK since the 1990s and has been at the forefront of quality and research initiatives in trauma care. It is the largest trauma registry in Europe and is clinically led, academic and independent.

TARN use a standardised dataset for trauma patients, allowing review of care at both organisational and national level, thereby assuring the quality of and ultimately improving trauma care.



The Quality Improvement Division (QID) was established to support the development of a culture that ensures improvement of quality of care is at the heart of all services that the HSE delivers. HSE QID works in partnership with patients, families and all who work in the health system to innovate and improve the quality and safety of its care.

ACKNOWLEDGING SIGNIFICANT CONTRIBUTIONS FROM THE FOLLOWING:











NOCA would like to thank Mr Kieran Minihane; Mrs Aoife Minihane; RCSI; The National Ambulance Service; The National Emergency Medicine Programme; Cavan General Hospital; Cork University Hospital; Mater Misericordiae University Hospital and St James's Hospital for supplying imagery used throughout this report.

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Major Trauma Audit

National Report

2016



Dr Conor Deasy Clinical Lead Major Trauma Audit National Office of Clinical Audit 2nd Floor, Ardilaun House 111 St. Stephen's Green Dublin 2

8th December 2017

Major Trauma Audit National Report 2016

Dear Dr Deasy,

Many thanks for your presentation of the 2016 Major Trauma Audit National Report to the Board in November, and the follow up final report, which on behalf of the Board, I am pleased to endorse.

On behalf of the Board I commend you and your colleagues for the significantly improved data capture in 2016 and, in particular the confirmation of the high quality of the data entered at 96%.

I welcome the quality improvement initiatives based on the Major Trauma Audit National Report at a local level in several hospitals documented in the report.

We look forward to continued quality improvement initiatives by you and your colleagues to effect improvement in trauma care, benchmarked within the wider TARN network.

Congratulations and well done.

J. Conor O'Keone

Yours sincerely,

Professor Conor O' Keane FFPath FRCPI

Chair

National Office of Clinical Audit Governance Board

PREFACE

This is the second national report for the Major Trauma Audit (MTA) and the first that includes data from 26 trauma-receiving hospitals. The MTA describes the care and clinical outcomes of patients who experience major trauma in Ireland. It focuses on data collected in 2016 for 4,426 patients. It is aimed at clinicians and healthcare staff who are delivering care and who are interested in improving the standard of trauma care. It will also be of interest to hospitals and Hospital Group Chief Executive Officers and Managers, Clinical Directors, Quality and Safety Managers, those commissioning trauma services, and to patient groups. This report summarises clinical findings at national level as well as patient outcomes.

The Major Trauma Audit National Report 2014-2015 highlighted that 40% of major trauma patients were aged 65 years and older and the most common cause of major trauma was falls from less than two metres, i.e. 'low falls' (NOCA, 2016). This report places a specific focus on age and how it relates to the incidence, processes and outcomes in trauma care. The age structure of the Irish population is changing; the Central Statistics Office (CSO) (2016) shows that the population aged 65 years and older has increased by 19.1% since 2011. This rise is expected to continue. By 2030, it is expected that there will be a 100% increase in those aged 85 years and over (WHO, 2011). Analysis suggests that if the current trends persist, people aged 75 years and over will make up the largest single group of patients with major trauma (Kehoe et al., 2015).

We need to celebrate our older population and prepare for the impact and challenges the changing age demographic will have on our healthcare services. Significant challenges exist in our current healthcare services and the ultimate goal of the MTA is to improve processes and outcomes for all patients. Improvements in outcomes from major trauma care may be expected if we develop a healthcare system that is configured to bring the right patient to the right hospital for the right treatment at the right time. Given that we have a large proportion of older people in the population, we must ensure that our health service is age attuned to meet older patients' needs.

Last year's report highlighted the large number (30%) of patients who attended hospitals that were unable to provide the necessary and appropriate care necessitating subsequent transfer for definitive treatment (NOCA, 2016). Strategic planning of a national trauma system is currently a priority for the Department of Health. This is welcomed by the National Office of Clinical Audit (NOCA) Major Trauma Audit Governance Committee which will help provide data to inform strategy and monitor outcomes.

We would like to take this opportunity to acknowledge all those involved in the provision of major trauma services in Ireland. We also wish to thank the Major Trauma Audit Clinical Leads and Data Coordinators, whose dedication and commitment is essential in driving quality assurance and improvement in the provision of trauma care in Ireland.

Dr Conor Deasy

Clinical Lead Major Trauma Audit National Office of Clinical Audit **Dr Rachael Doyle**

Consultant Geriatrician St. Vincent's University Hospital and St. Columcille's Hospital National Clinical Programme for Older People

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Probability of survival (PS)

Median time to surgery by body region and age band

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EXECUTIVE SUMMARY

The National Office of Clinical Audit (NOCA) established the Major Trauma Audit (MTA) in 2013. This audit focuses on the care of the more severely injured trauma patients in our healthcare system. The Trauma Audit and Research Network (TARN) provides the methodological approach for the MTA in Ireland and all 26 eligible hospitals now submit data to the MTA.

In 2016, the MTA became the first national clinical audit endorsed by the National Clinical Effectiveness Committee (NCEC) and mandated by the Minister for Health. This second report presents findings on 2016 data.

PROGRESS SINCE THE LAST REPORT

In the previous report, it was recommended that a standardised document be developed for the reception of trauma patients by the multidisciplinary team. This work is ongoing and is discussed in Chapter 8.

Following the findings in the previous report regarding the proportion of older major trauma patients, NOCA engaged with the National Clinical Programme for Older Persons and sought a geriatrician representative for the MTA Governance Committee. This report focuses on major trauma across different age bands, with Chapter 7 focusing on the care of older major trauma patients.

Last year's report identified that the most common mechanism of injury was 'low falls'; NOCA is working with the HSE to provide data and support for the prevention and management of 'low falls'.

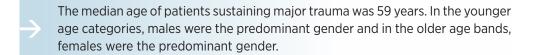
Pre-hospital care data capture is evolving and moving to an electronic platform; it is anticipated that this will make pre-hospital data provision to the MTA more accessible.

THE VISION FOR MAJOR TRAUMA AUDIT

The MTA is a fundamental building block of any trauma system. MTA is now a well-established robust national clinical audit and as such is in a good position to measure the quality of care provided to patients sustaining major trauma in Ireland. This audit will continue to be a key source of data for the HSE and National Clinical Programmes to monitor changes in processes and outcomes associated with the development of major trauma networks. Work has commenced to include patient-reported outcome measures (PROMS), e.g. quality of life and functional outcomes as part of the MTA.

NOCA will continue to engage with hospitals to ensure that high-quality data are collected and appropriate supports are given for the collection of data. It will be used to drive improvements in the standard of trauma care delivery as Ireland moves to develop an integrated trauma system.

MAJOR TRAUMA AUDIT 2016 **KEY FINDINGS**



- Twenty-eight per cent of patients had to be transferred to another hospital for ongoing care as their care needs could not be provided by the initial receiving hospital.
- The mechanism of injury varies by age band, with road trauma and blows dominating the younger age bands and 'low falls' dominating the older age bands.
- Advanced age correlates with higher numbers of comorbidities, making the clinical management of older major trauma patients more complex and difficult, and requiring a multidisciplinary approach.
- Forty-seven per cent of major trauma occurred at home; 39% occurred in a public area and road.
- Only 8% of patients were received by a trauma team on arrival to hospital.
- Older patients were less likely to be pre-alerted and reviewed by a senior clinician.
- Older patients are more likely to die and suffer higher levels of disability than younger major trauma patients with a similar injury severity score (ISS).
- Only 62% of major trauma patients were discharged directly home. Older patients are less likely to be discharged home and more likely to be discharged to rehabilitation or long-term care compared to younger patients.
- Four per cent of major trauma patients died in hospital as a result of their injuries.
- The data completeness or data capture has significantly improved from 55% in 2015 to 74% in 2016 and there were nine hospitals that achieved the TARN Data Quality Standard of greater than 80% completeness.
- The data accreditation for 2016 is 96%, meaning that when patients were identified for audit the relevant details were captured to an excellent standard.

REPORT HIGHLIGHTS 2016

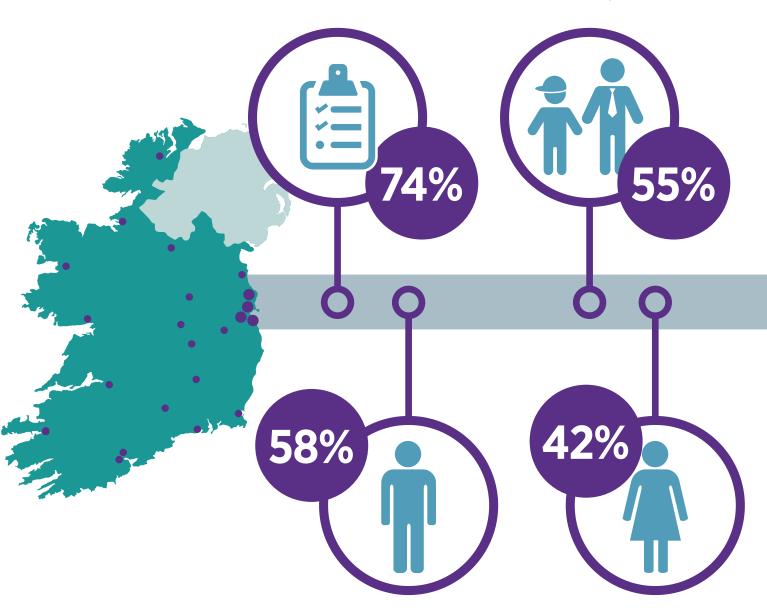
26 PARTICIPATING HOSPITALS

COMPLETENESS

74% of MTA cases captured in 2016

PATIENT AGE PROFILE

55% of patients were aged between 15 and 64 years



Percentages shown are representative of the cases entered in MTA in 2016

GENDER

58% of patients were male

GENDER

42% of patients were female

MOST COMMON INJURY LOCATION

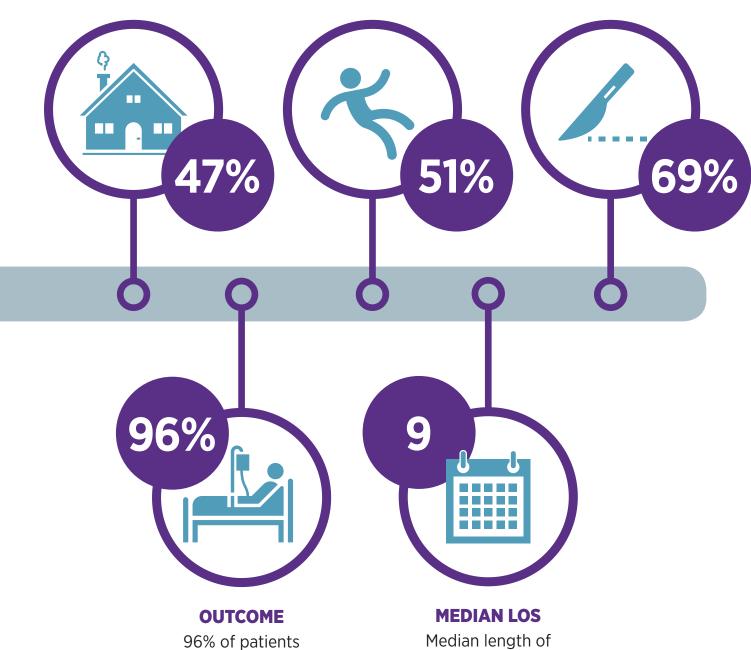
47% of patients sustained an injury in their own home

MOST COMMON MECHANISM

51% of patients had a 'low fall' of less than 2 metres

SURGERY

69% of patients who had surgery had surgery on a limb/s



96% of patients survived

Median length of stay was 9 days

DATA QUALITY AND CLINICAL CARE 2016

	2016	
DATA QUALITY		
Number of participating hospitals	26	
Number of individual patients	4,426	
Completeness	74%	
Accreditation	96%	

CLINICAL CARE		
Percentage seen by an advanced paramedic*	33% n=760/2,317	
Percentage seen by a consultant in the ED	22% n=706/3,194	
Time to CT (hours) for head injury patients with Glasgow Coma Scale (GCS) <13	1.3 (0.9-2.3)	
Median length of stay (LOS) [†]	9 (5-17 days)	
Median Intensive Care Unit (ICU) LOS	3 (1-8 days)	
Mortality	4%	

^{*}In 2016 - Number of paramedics - 2,071

Number of advanced paramedics – 479 (PHECC)

 $^{^{\}dagger}$ LOS refers to calendar days. Median LOS for this report was calculated by:

¹⁾ Summing the total length of stay for each MTA patient. For example, if a patient stayed in hospital A for two days and was then transferred to hospital B for five days, their total length of stay was calculated as seven days.

²⁾ The median LOS was then calculated from each patient's total LOS.

AIM OF MAJOR TRAUMA AUDIT

"The MTA will drive quality improvement to achieve the best possible clinical outcomes for trauma patients in Ireland."



OBJECTIVES OF THE MAJOR TRAUMA AUDIT

- To benchmark trauma care both nationally and internationally.
- To promote reflective clinical practice and to encourage peer review at local and national level.
- To provide high-quality data to enable peer-reviewed research.



INTRODUCTION

Severely injured patients cannot select their preferred hospital. These injuries occur without warning and often far from a hospital suitable for treating such injuries. A patient's route into the healthcare service is often influenced by the location of the trauma and the availability of services in that location, including the responding emergency personnel, emergency service, specialty services, critical care capacity and rehabilitation. Often, these patients require input and care from multiple specialities; Ireland does not currently have a coordinated, integrated trauma system with pre-determined, seamless patient pathways in place. No hospital in Ireland reaches major trauma centre designation criteria. Almost one in three MTA patients are transferred to another hospital to complete the treatment they require (NOCA, 2016).

The coordination and availability of the required trauma services can have an impact on the timeliness of care and intervention and therefore can determine patients' outcomes and level of disability if they survive. To ensure that patients get the best opportunity for recovery and survival, many jurisdictions have developed an integrated trauma system. In the United Kingdom (UK) the development of trauma networks has reduced the mortality rate by 30% along with significantly improving survivors' quality of life. To achieve this, health system resources have been strategically redistributed rather than massively increased (IAEM, 2014).

One of the key factors underpinning the success of an integrated trauma system is high-quality data to facilitate local, regional and national quality assurance and improvement initiatives. The Major Trauma Audit (MTA) in Ireland was established by NOCA in 2013. NOCA has engaged the internationally recognised TARN as the methodological approach for MTA in Ireland. Eligible trauma-receiving hospitals were identified by NOCA with the HSE National Emergency Medicine Programme. There are now 26 trauma-receiving hospitals participating in the MTA. This has been achieved since October 2013.

ABOUT THE TRAUMA AUDIT AND RESEARCH NETWORK (TARN)

TARN has been in operation in the UK since the 1980s and has been at the forefront of quality and research initiatives in trauma care. It is the largest trauma registry in Europe and is clinically led, academic and independent. TARN has been integral to the reconfiguration of trauma care delivery in England and monitors the effects of the changes implemented. TARN receives and analyses anonymised MTA submissions from participating Irish hospitals and reports back to these hospitals. This feedback from TARN and NOCA is supporting hospitals' and clinicians' learning and continuous improvement of care delivered to patients with major trauma.

PATIENT STORY

ROBERT*

Robert is an active 82-year-old man who was out for a walk and, as he crossed the road, he was knocked down by a vehicle and dragged some distance. An ambulance was called by passers-by and after a very short time, help arrived. Due to the nature of Robert's injuries, an advanced paramedic (AP) was also dispatched to the scene in a rapid response vehicle.

The biggest issue facing Robert at the scene of the accident was blood loss because he was on medication to thin his blood. Both his legs were quite severely crushed. The AP and the paramedics worked hard to control the bleeding and make Robert more comfortable before he was transferred to hospital.

The hospital was notified that Robert was on his way and the trauma team was informed. Robert was assessed and treated using Advanced Trauma Life Support principles by a large team comprising emergency medicine, anaesthetic, surgical, radiology specialties, emergency nurses and radiographers. A whole-body CT scan revealed that Robert had no injuries to the head, thorax or intra-abdominal region; however, he had sustained significant damage to the skin, muscles, bones, nerves and blood vessels of his legs. He had also fractured his left forearm. In the operating theatre, skilled orthopaedic and plastic surgeons together salvaged his left leg; it was necessary to amputate his right leg below the knee. His forearm fracture was manipulated into a good position to heal and a cast was applied. After surgery, Robert was brought to the intensive care unit (ICU) as he had sustained significant blood loss which required careful monitoring.

After a period in the ICU, Robert was transferred to the orthopaedic ward. During this time, he had clinical input from surgeons, geriatricians, haematologists, rehabilitation specialists, physiotherapists, occupational therapists, social workers, nursing and care assistant staff, all supporting his rehabilitation and helping him to plan for his discharge.

COMMENT

Thanks to the competent and timely care received pre-hospital and within the emergency department (ED), Robert had the best possible outcome from a very complicated trauma. This case highlights the range of specialties required to ensure that a patient's journey from roadside to recovery is as short as possible. Luckily, Robert got the right care at the right time; this meant he did not develop sepsis as a result of an open fracture. For example, he had safe and efficient management of his blood clotting, and he did not spend long periods of time in the acute hospital awaiting a prosthesis or for his home to undergo the necessary alterations to facilitate his safe discharge.

*Patients' real name has not been used to maintain patient confidentiality.



WHO IS THIS REPORT AIMED AT?

The work reported here is intended for the use of a wide range of individuals and organisations, including:

- Patients and carers
- Patient organisations
- Healthcare professionals
- Hospital managers
- Hospital Groups
- Policy-makers

The report has been designed in two parts:

- 1 The MTA National Report 2016 presents key findings on casemix, patient journey, care pathways and outcomes. This report follows the patient's pathway from the scene of the trauma and pre-hospital care to the ED, radiology, critical care, surgery, specialty services, rehabilitation and discharge.
- 2 The MTA National Report 2016: Summary Report. This report highlights the main findings of the analysis of the MTA data and will be of particular interest to patients, patient organisations and the public.



NOTE: Dublin hospitals have been displayed collectively by Hospital Group

SAOLTA UNIVERSITY HEALTH CARE GROUP

Letterkenny University Hospital Mayo University Hospital Sligo University Hospital University Hospital Galway

RCSI HOSPITALS

Beaumont Hospital Cavan General Hospital Connolly Hospital Our Lady of Lourdes Hospital, Drogheda

DUBLIN MIDLANDS HOSPITAL GROUP

Midland Regional Hospital, Tullamore Midland Regional Hospital, Portlaoise Naas General Hospital St James's Hospital, Dublin Tallaght Hospital (Adults)

IRELAND EAST HOSPITAL GROUP

Mater Misericordiae University Hospital Regional Hospital Mullingar St. Luke's General Hospital, Kilkenny St. Vincent's University Hospital Wexford General Hospital

THE CHILDREN'S HOSPITAL GROUP

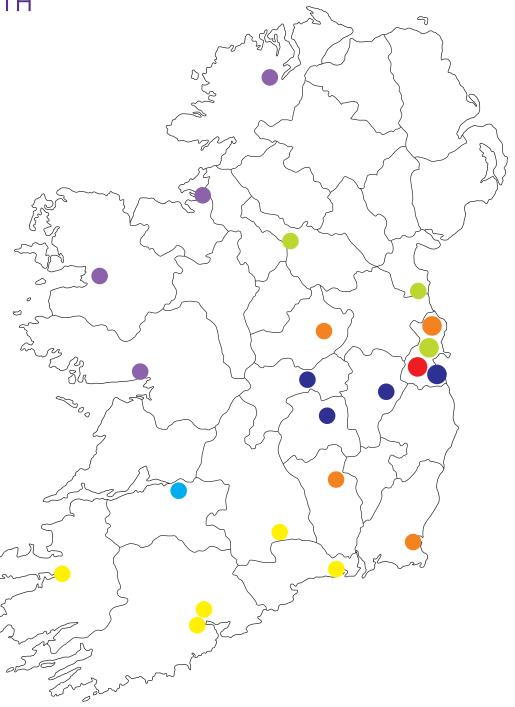
Our Lady's Children's Hospital Crumlin Tallaght Hospital (Paediatrics) Temple Street Childrens University Hospital

UL HOSPITAL GROUP

University Hospital Limerick

SOUTH/SOUTH WEST HOSPITAL GROUP

Cork University Hospital
Mercy University Hospital
South Tipperary General Hospital
University Hospital Kerry
University Hospital Waterford



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SAOLTA UNIVERSITY			Sarah Meagher
	Mayo University Hospital	Dr Ciara Canavan	Paul Crisham
HEALTH CARE		Dr Andrew Jackson	
GROUP		Dr Ann Shortt	
	Sligo University Hospital	Dr Kieran Cunningham	Rosemary Maguire
	University Hospital Galway	Mr Alan Hussey	Paul Crisham
	Beaumont Hospital	Dr Patricia Houlihan	Anna Duffy
			Sarah Connor
RCSI	Cavan General Hospital	Mr Ashraf Butt	Eilish Sweeney
HOSPITALS	Connolly Hospital	Dr Emily O'Conor	Therese Yore
	Our Lady of Lourdes Hospital,		
	Drogheda	Dr Niall O'Connor	Deborah McDaniel
	Midland Regional Hospital, Tullamore	Dr Anna Moore	Neil Perry
		Dr Sean O'Rourke	
DUBLIN	Midland Regional Hospital, Portlaoise	Dr Suvarna Maharaj	Louise Cooke
MIDLANDS	Naas General Hospital	Dr George Little	Breda Murphy
HOSPITAL	St James's Hospital, Dublin	Mr Niall Hogan	Alison Reynolds
GROUP	01 0a00 0 1100p.ta., 2 a.z	Dr Geraldine McMahon	, meen negmende
	Tallaght Hospital (Adults)	Dr Jean O'Sullivan	Noel Redmond
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	Mater Misericordiae University Hospital	Dr Tomás Breslin	Marian Lynders
	Degional Hospital Mullinger	Mr Seamus Morris Dr Sam Kuan	Helen Evans
	Regional Hospital Mullingar	Dr Saill Kudil	
			Máire Maguire Wendy O'Doherty
IRELAND	St. Luke's General Hospital, Kilkenny	Dr David Maritz	Frances Walsh
EAST	St. Luke's General Hospital, Klikeling	Dr Frank O'Dwyer	Fidilces Waisii
HOSPITAL	St. Vincent's University Hospital	Dr John Cronin	Jenny Beatty
GROUP	St. Vincent's Onliversity Hospital	Di Joini Cionni	Sorcha Burns
			Brenda Cormican
	Wexford General Hospital	Dr Paul Kelly	Mary Doyle
	Trextora deficial flospital	Dr Michael Molloy	Jennifer Power
		Di Filender Floridy	Shelagh Twomey
	Our Lady's Children's Hospital Crumlin	Dr Carol Blackburn	Suzanne Byrne
THE		Mr Brian Sweeney	Julie Hughes
CHILDREN'S	Talle whet the write LOD and in their co	Du Ciana Mantin	Louise Purcell
HOSPITAL GROUP	Tallaght Hospital (Paediatrics)	Dr Ciara Martin Professor Alf Nicholson	Noel Redmond
GROUP	Temple Street Children's University Hospital	Professor All Nicholson	Jennifer Doyle
UL HOSPITAL	University Hospital Limerick	Dr Cormac Mehigan	Eoin Barry
GROUP	2 G.		Michael Fitzpatrick
	Code Hartenana H	Du Charad Al	·
	Cork University Hospital	Dr Sinead Ahern	Karina Caine
	Morey University Heavital	Mr James Clover	Ann Deasy
SOUTH/	Mercy University Hospital	Dr Chris Luke	Ann Deasy
SOUTH WEST	South Tipperary General Hospital	Mr Cyrus Mobed	Susan Ryan
HOSPITAL	University Hospital Kerry	Dr Martin Boyd	Esther O'Mahony
GROUP	Hoisewith Hearthal Material	Dr Niamh Feely	Maygayet Millerh
	University Hospital Waterford	Dr Des Fitzgerald Mr Morgan McMonagle	Margaret Mulcahy

MAJOR TRAUMA AUDIT NATIONAL REPORT 2016 KEY RECOMMENDATIONS

INFORMING TRAUMA POLICY:



Reconfiguration of trauma services is required to provide timely, appropriate and optimal care to major trauma patients to ensure the right patient is brought to the right hospital for the right treatment at the right time.



A national definition and a standard on what should constitute a trauma team and activation criteria for such a team are required.

Pre-hospital carers and emergency medicine professionals should exercise a high level of suspicion of major trauma in older patients with low-energy mechanism injuries.



To support this approach to care:

- · Clinical assessment and triage tools should be adapted to suitably assess older patients.
- Education programmes for pre-hospital carers and emergency medicine professionals should include care for the older patient with low-energy mechanism injuries.

DATA QUALITY:



MTA is an NCEC-accredited audit and the participating hospitals must support the resourcing of data collection for this audit. Data completeness of at least 80% and data accreditation of 95% are required to ensure good data quality and reporting.



NOCA will work with the Healthcare Pricing Office, TARN and hospitals to adjust the annual hospital denominators to reflect accurately the level of completeness of individual hospitals' data.



Functional and quality-of-life measures should be included in the future development of the audit.



MTA METHODOLOGY

DATA COLLECTION PROCESS (INCLUSION CRITERIA)*

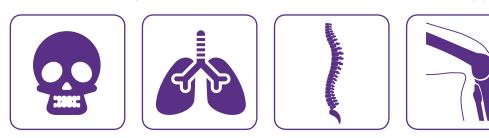
All trauma patients, irrespective of age



who fulfil one of the following length-of-stay (LOS) criteria



and whose isolated injuries meet one of the criteria identified in Appendix 1



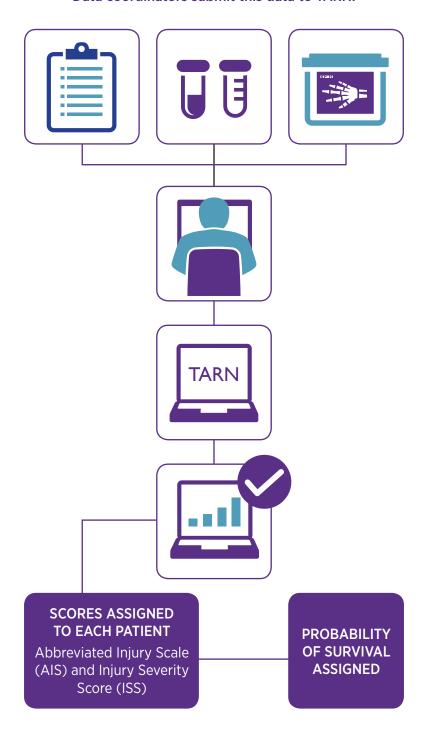
GOVERNANCE STRUCTURE



^{*} This report details all major trauma patients who fulfill the inclusion criteria, including those with all classifications of Injury Severity Score (ISS).

DATA COLLECTION PROCESS

Data is collected from various sources such as the pre-hospital care record; hospital clinical records, including laboratory and radiology; the Hospital In-Patient Enquiry (HIPE) Scheme; the Integrated Patient Management System (IPMS); coroners' reports; and other data systems. Data coordinators submit this data to TARN.





DATA QUALITY

DATA FOR THIS MTA REPORT

Analysis for this report, as captured by TARN, includes patients who:

- I. Arrived for trauma care between 1st January 2016 and 31st December 2016
- II. Fulfilled the TARN eligibility criteria for inclusion (see Appendix 1)

TABLE 2: DATA ANALYSIS FOR MTA REPORT 2016		
	2016	
Number of participating hospitals	26	
All TARN submissions ¹	5,088	
Individual patients	4,426	
Direct admissions (i.e. did not require transfer)	3,194	

QUALITY ASSURANCE

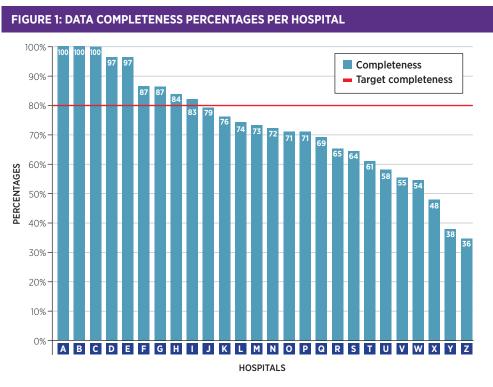
TARN provides measures of data completeness and accreditation as a means of assessing the quality of MTA data.

DATA COMPLETENESS

The data completeness refers to the measure of major trauma cases with data entered against the overall expected number of cases (this is also referred to as 'case ascertainment' in TARN). The expected number of cases per hospital is estimated based on the Hospital In-patient Enquiry (HIPE) file for each hospital for the previous year. The TARN eligibility criteria for inclusion (Appendix 1) are applied to the national HIPE file for the previous year and an estimate of expected cases is then generated for each hospital. This methodology has limitations in that it over states the number of eligible patients and inflating the denominator; NOCA is currently working towards a solution to resolve this problem.

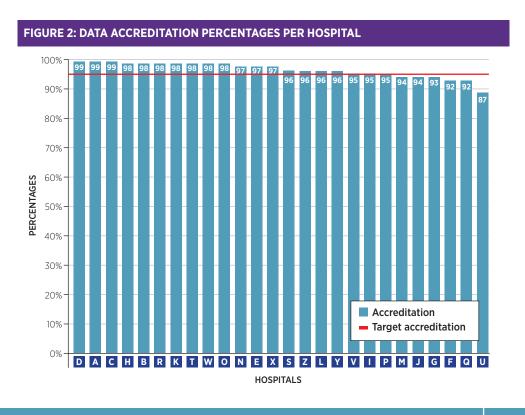
The national completeness level for the 2016 MTA is 74%, (Figure 1), which is a considerable improvement from the 55% for 2015. Nine hospitals achieved the TARN Data Quality Standard for Data Completeness target of 80% completeness in 2016. Throughout the year, NOCA has provided hospitals and Hospital Groups reports which identify if completeness was below the expected standard. Hospitals should prioritise data collection and compliance with the MTA as it is a national clinical audit mandated by the Minister for Health. It demonstrates the quality of care provided within hospitals and acts as a comparator towards national and international standards of care.

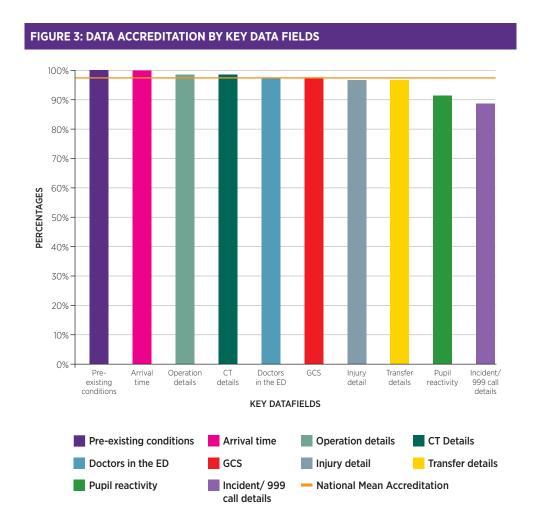
Patients may have required transfer to another hospital and therefore may have multiple submission entries.



DATA ACCREDITATION BY HOSPITAL

The completion of key data fields is used as the second measure of data quality. TARN applies a standard of 95% for this measure. The national data accreditation level for the MTA is 96%, which is excellent (Figure 2). Twenty hospitals achieved the data accreditation national standard.





There has been ongoing education provided by NOCA to the data coordinators and clinical leads on maximising the capture of pre-hospital data and pupil reactivity, which contribute to the data accreditation score, (Figure 3).

DATA MATURITY

As this audit and data mature, it is envisaged that individual hospital comparisons will be identified and presented in future reports.





51% OF MAJOR TRAUMA PATIENTS SUFFERED INJURY FROM A 'LOW FALL' (LESS THAN 2M)

WHO WAS INJURED AND HOW WERE THEY INJURED?

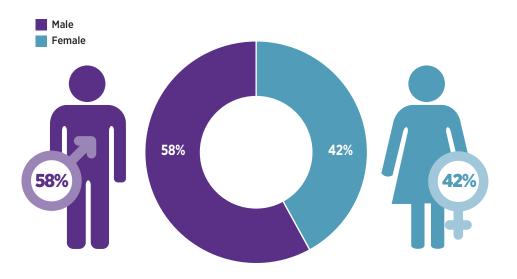
GENDER AND AGE BAND

This chapter provides a profile of the 4,426 patients included in the 2016 MTA and their injuries.

FINDINGS

Forty-two percent (n=1,843) of patients were female and 58% were male (n=2,583), (Figure 4).

FIGURE 4: GENDER BREAKDOWN OF MAJOR TRAUMA PATIENTS (N=4,426)



FINDINGS

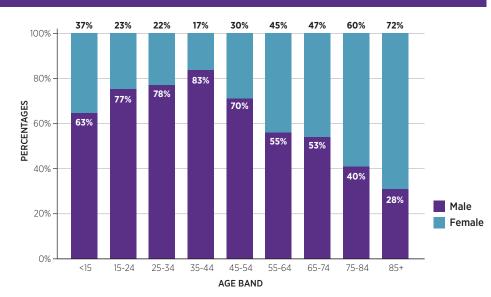
The mean age of patients was 55 years and the median age was 59 years. In the age categories from early childhood to 54 years, males were the predominant gender among patients and in those aged 55 years and over, females were the predominant gender (Figure 5).

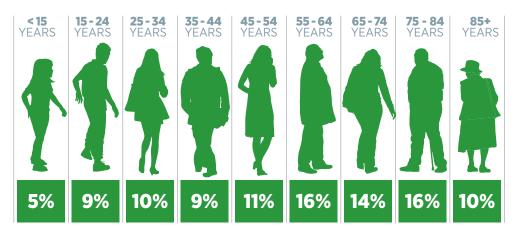
For the analysis of this report, the age band for children will be presented for children aged under 15 years which differs from the last report. This has facilitated an analysis showing 10 year age bands. This data show us that children aged under 15 years represented 5% (n=219) of patients; for comparison with last year's report and the national definition of a child, those aged under 16 represented 5% (n=237).

Fifty-five per cent (n=2,437) of patients were aged 15-64 years and in the working-age population.

Older adults, aged 65 years or over, represented 40% (n=1,770) of patients.







PRE-EXISTING MEDICAL CONDITIONS

FINDINGS

The Charlson Comorbidity Index (CCI) has been adapted and validated for predicting the outcome and risk of death for many comorbid diseases (Charlson *et al.,* 1987). The CCI is used in statistical adjustment for comorbidities in TARN. Older patients will generally have a greater burden of significant pre-existing comorbidities. Half of the patients included in this report had no significant pre-existing comorbidities, 37% (n=1,623) of patients had mild comorbidities, and 2% (n=102) had severe comorbidities (Figure 6).

The distribution of comorbidities, when presented by age bands, clearly shows that the severity of comorbidities increases with age, (Figure 6A).



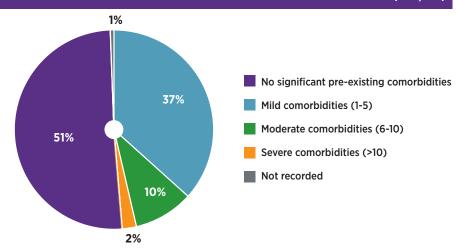
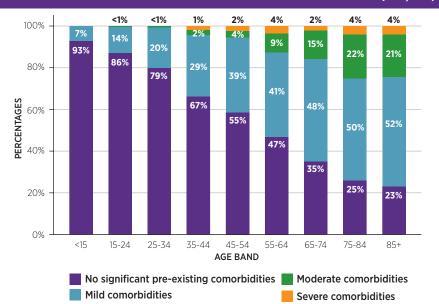


FIGURE 6A: COMORBIDITIES OF MAJOR TRAUMA PATIENTS BY AGE BAND (n=4,400) **



- ⁱ Please note: Percentages may not sum to 100% due to rounding.
- * Patients with missing information on Charlson comorbidity index score (n=26) are excluded.

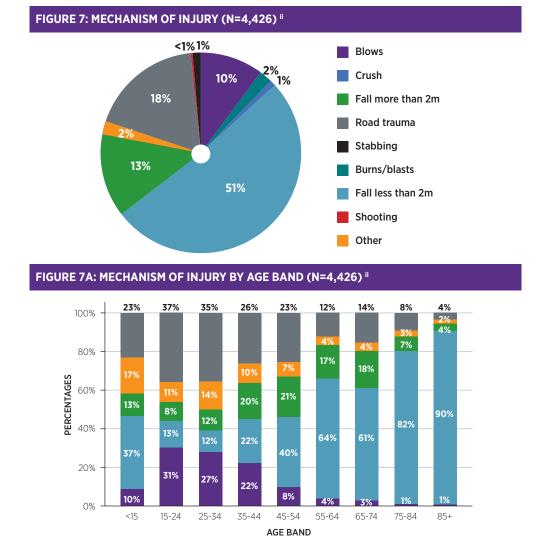
MECHANISM OF INJURY

FINDINGS

Falls of less than 2 metres termed 'low falls' are the most frequent cause of injury (51%, n=2,272), followed by road trauma (18%, n=807) and falls of greater than 2 metres (13%, n=594), (Figure 7).

The mechanism of injury changes with age. In older patients, 'low falls' are most common; in younger age bands, road trauma and 'blow(s)' (this refers to blunt contact such as a punch or kick) are most prevalent, (Figure 7A).

Blunt trauma accounts for 96% (n=4,258) of trauma, of which 3% (n=154) was penetrating trauma, e.g. shootings and stabbings. Other, representing 2% (n=96) of cases, refers to cases of asphyxia due to hanging (n=34), drownings (n=8) and other cases.



 $^{^{\}mbox{\tiny II}}$ Please note: Percentages may not sum to 100% due to rounding.

Falls less than 2m

Blows

Road trauma

Falls more than 2m

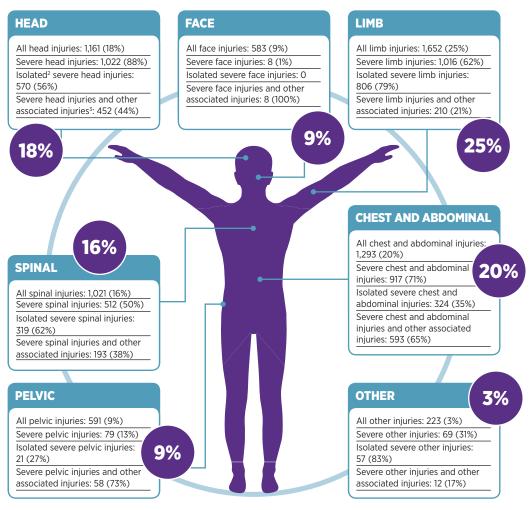
Other*

^{* &#}x27;Other' category contains: Burns/blasts, crush, stabbing and shooting.

INJURIES SUSTAINED

FIGURE 8: INJURIES SUSTAINED BY BODY REGION (N=6,524)

All injures1 recorded: 6,524



¹ All injures- all injuries to specific body region with AIS 1-6

TABLE 3: NUMBER OF INJURIES SUSTAINED PER PATIENT NUMBER OF INJURIES 3,049 69 2 895 20 3 306 7 4 126 3 5 39 1 6 9 <1 7 2 <1 100 Total 4,426

² Isolated body region- Body region e.g. head, pelvis, with AIS= 3-6 with no other injuries

³ Body region and other associated injuries: Body region e.g. head, pelvis with AIS= 3-6 in addition to another injury AIS 1-6

INJURY SEVERITY SCORE

When auditing the management of major trauma, it is important to have a method for grading the severity of trauma sustained by a patient. Each injury is scored between one and six based on its severity. An AIS score of one represents a minor injury; whereas an AIS score of six represents an injury that is not survivable (Appendix 1). This contributes to the overall Injury Severity Score (ISS) for that patient, which is rated on a scale from 0 to 75 (Gennarelli and Wodzin, 2008). Examples are presented in Table 4.

TABLE 4: ISS CLASSIFICATION			
ISS CLASSIFICATION	ISS SCORE	EXAMPLES OF INJURIES	
Low-severity injury	1-8	Fractured wrist and ankle Simple skull fracture Small bleed in liver	
Moderate-severity injury	9-15	Fractured femur Small brain contusion (bruising)	
Severe injury	> 15	Large subdural haematoma (bleed between skull and brain) Fracture of the pelvis with significant blood loss Severe injuries to multiple body regions	

FINDINGS

A breakdown of the ISS across all injured patients is presented in Figure 9. This shows that 42% (n=1,860) of major trauma patients suffered moderate severity injury and 31% (n=1,374) suffered severe injuries.

The distribution of ISS by age band is shown in Figure 9A. This distribution is similar across all age bands.

FIGURE 9: INJURY SEVERITY SCORE (ISS) (N=4,426)

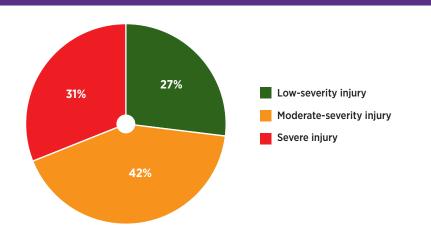
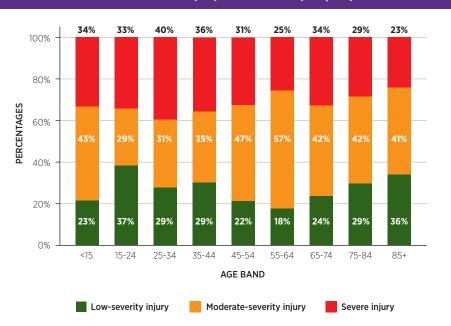


FIGURE 9A: INJURY SEVERITY SCORE (ISS) BY AGE BAND (N=4,426) **



 $^{^{\}mbox{\tiny III}}$ Please note: Percentages may not sum to 100% due to rounding.

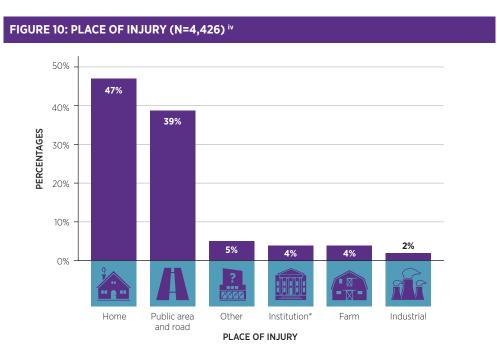
PLACE OF INJURY

FINDINGS

Home was the location where injury was sustained in 47% of patients (n=2,077). This includes 77 patients who were injured in 'other home- not patient's'. Thirty nine percent (n=1,714) of injuries occurred in a public place or road, (Figure 10).

The place of injury is presented by age in Figure 10A. Home is the most common place of injury overall; it is the predominant place of injury in the <15-year-old age band and those aged 55 years and older. Major trauma patients aged between 15 and 54 years are more likely to be injured on the public area and road.

Figure 10B describes the ISS score by place of injury.



 $^{^{\}ast}$ Institution includes hospitals, prisons, care homes and educational institutions such as schools.

iv Please note: Percentages may not sum to 100% due to rounding.

FIGURE 10A: PLACE OF INJURY BY AGE BAND (N=4,426) v

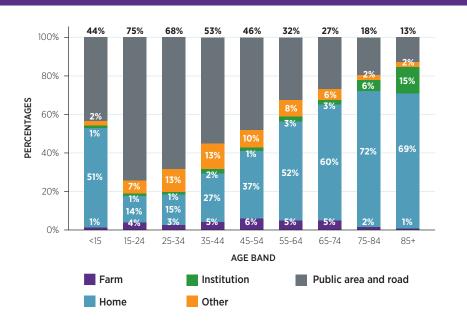
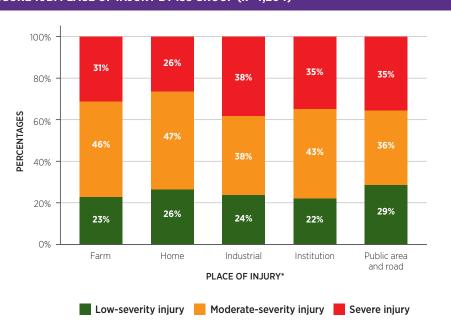


FIGURE 10B: PLACE OF INJURY BY ISS GROUP (n=4,204) v



^{*} Patients with place of injury classified as 'Other' (n=222) are excluded.

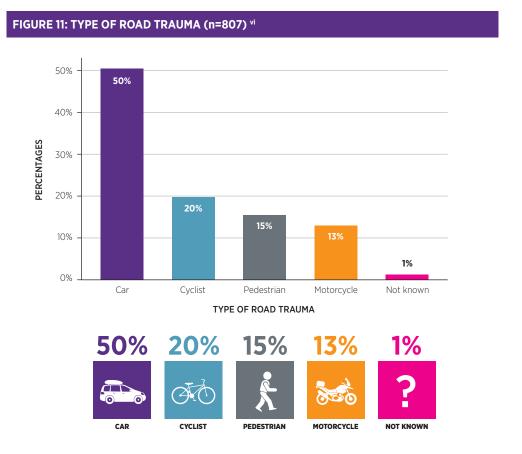
 $^{^{\}scriptscriptstyle \rm V}$ Please note: Percentages may not sum to 100% due to rounding.

TYPE OF ROAD TRAUMA

FINDINGS

Road trauma accounts for 18% (n=807) of all trauma. Fifty per cent (n=407) of road trauma involved car occupants, 20% (n=160) cyclists, 15% (n=125) pedestrians and 13% (n=105) motorcycles, (Figure 11).

Figure 11A shows that 67% (n=271) of major trauma patients involved in road trauma are injured in the driver's seat. Pedestrians had the highest percentage of severe injury (ISS >15) caused by road trauma (56%), (Figure 11B).



 $^{^{\}mbox{\tiny vi}}$ Please note: Percentages may not sum to 100% due to rounding.



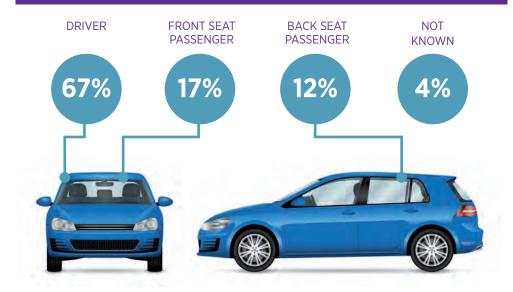
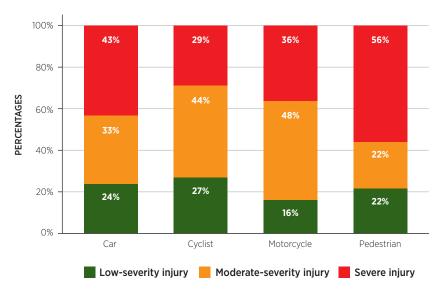


FIGURE 11B: TYPE OF ROAD TRAUMA BY ISS GROUP (n=797) *



 $^{^{}st}$ Patients with missing information on mechanism of road trauma (n=10) are excluded.

INJURIES SUSTAINED AT HOME

FINDINGS

The home was the most common location of injury, with 47% (n=2,077) of injuries sustained there, (Figure 10). In order to determine what factors may influence such a high incidence of injuries in this location, we examined the following - location of injury by gender, age-band, ISS band, comorbidity and mortality.

- 54% (n=1,131) of major trauma patients injured at home were female, (Figure 12).
- Injuries at home are more common in females aged 75 years and older, (Figure 12A).
- 'Low falls' were the mechanism of injury in 72% (n= 1,501) of cases, (Figure 12B).



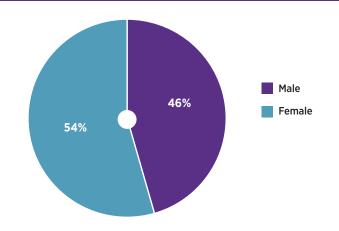
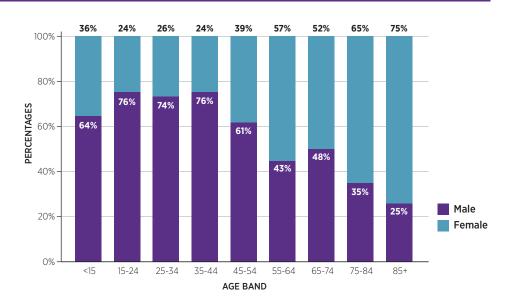
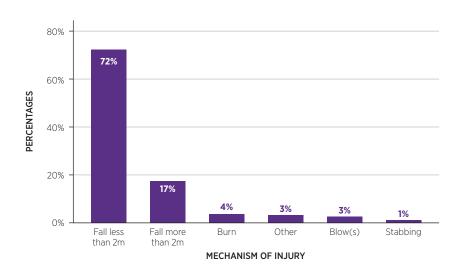


FIGURE 12A: INJURIES AT HOME BY GENDER AND AGE BAND (n=2,077)



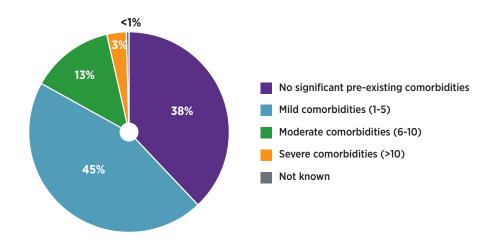




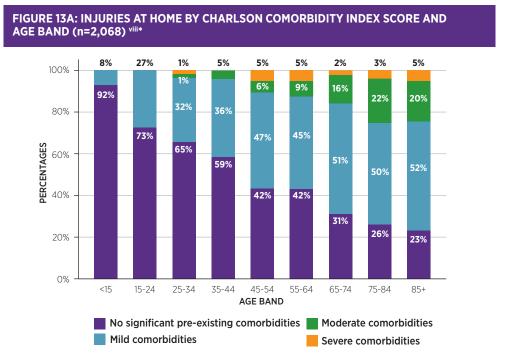
FINDINGS

Patients with moderate comorbidities (CCI score 6-10) accounted for 13% (n=278) and 3% (n=65) scored >10, indicating severe comorbidities, (Figure 13). There is a correlation between increasing age and higher levels of comorbidities, (Figure 13A).

FIGURE 13: INJURIES AT HOME BY CHARLSON COMORBIDITY INDEX SCORE (n=2,077) vii



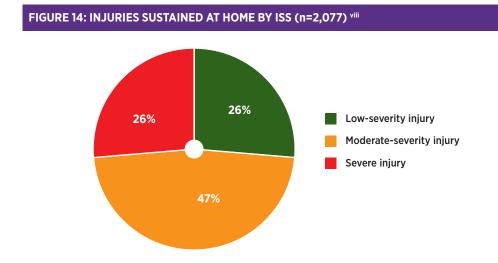
vii Please note: Percentages may not sum to 100% due to rounding



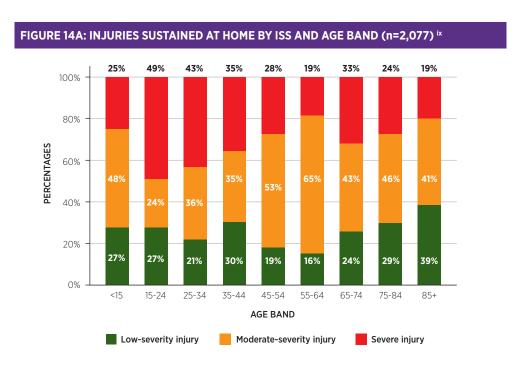
* Patients with missing information on Charlson index score (n=9) are excluded.

FINDINGS

Injuries at home resulted in a high percentage of moderate-severity injuries (47%, n=983) or severe injuries (26%, n= 547), Figure 14. The most severe injuries sustained at home are most predominant in the 15-24 and 25-34 age bands, (Figure 14A).



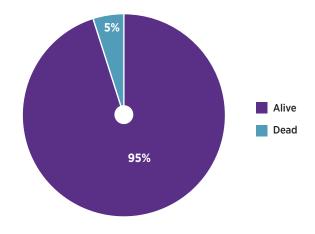
viii Please note: Percentages may not sum to 100% due to rounding.



FINDINGS

Of those injured at home (n=2,077), 5% (n=102) died during admission to hospital, (Figure 15).

FIGURE 15: INJURIES AT HOME BY MORTALITY (n=2,077)



 $^{^{\}mbox{\scriptsize ix}}$ Please note: Percentages may not sum to 100% due to rounding.

HEAD INJURIES

Head injuries, also referred to as traumatic brain injury (TBI), accounted for 18% (n=1,161) of all MTA injuries.

A marker of head injury on arrival of the patient at the ED is the level of consciousness measured by the Glasgow Coma Scale (GCS). There are three levels of consciousness recorded within head injury. A normal or minimally impaired consciousness level is given a score of 13-15, a moderate level is given a score of 9-12, with the most severe scoring 8 or lower. The majority of fatal outcomes are in the moderate or severe head injury group (NICE, 2014). Of those patients recorded with a GCS of 8 or lower in this report, 62% (n=96) survived.

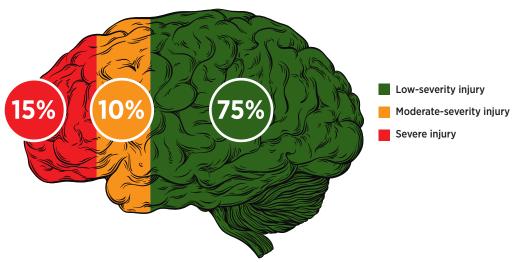
FINDINGS

The percentage of head injuries categorised with a minimally impaired consciousness level, i.e. GCS 13-15, accounted for 75% (n=748), a further 10% (n=97) had moderate head injury (GCS 9-12) and 16% (n=155) were considered to have a severe head injury indicated with a GCS or 8 or less, (Figure 16).

Figure 16A shows that severe head injuries were more common in the younger age bands.

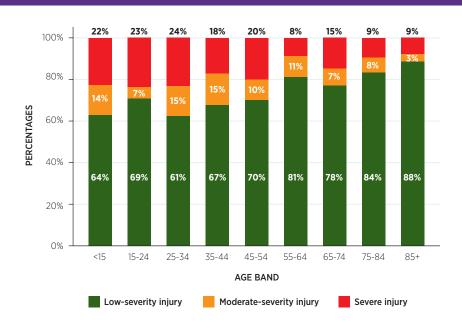
The predominant mechanism of injury in patients with severe TBI was road trauma (37%, n=58) followed by 'low falls' (26%, n=40) and falls of greater than 2 metres with (25%, n=39), (Figure 16B). The mechanism of injury varies considerably by age band, with road trauma being more prevalent in younger age bands and 'low falls' being most common for older people aged over 75 years, (Figure 16C).

FIGURE 16: HEAD INJURY SEVERITY (AIS 3+) (n=1,000)*



 * Patients with missing information on GCS (n=22) are excluded

FIGURE 16A: HEAD INJURY SEVERITY BY AGE BAND AND GCS (n=1,000)^x



 $^{^{\}scriptscriptstyle X}\,$ Please note: Percentages may not sum to 100% due to rounding.

FIGURE 16B: CAUSE OF INJURY IN PATIENTS WITH SEVERE TBI TOTALS (n=155)

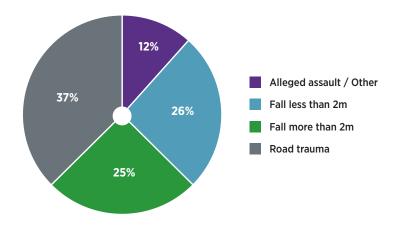


FIGURE 16C: CAUSE OF INJURY IN PATIENTS WITH SEVERE TBI BY AGE BAND (n=155) xi



 $^{^{\}mbox{\tiny xi}}$ Please note: Percentages may not sum to 100% due to rounding.



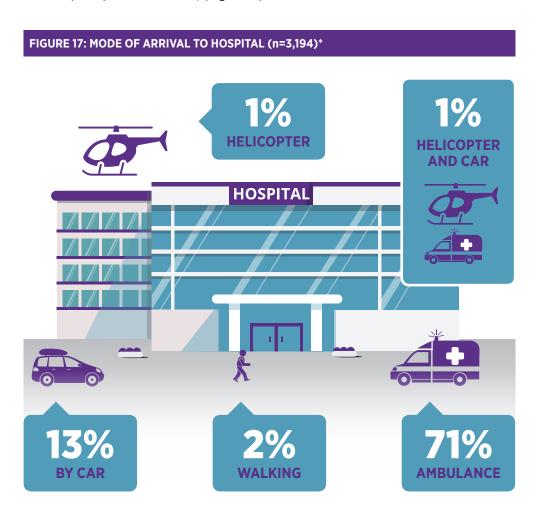
THE PATIENT JOURNEY

Optimal trauma care requires that every link in the chain of care is seamlessly joined up to ensure maximal survival and recovery of MTA patients.

MODE OF ARRIVAL TO HOSPITAL

FINDINGS

Ambulance was the most common mode of transportation to hospital (71%, n=2,263). Thirteen percent (n=400) of patients arrived by car, 1% (n=25) arrived by helicopter and 2% (n=69) arrived on foot, (Figure 17).



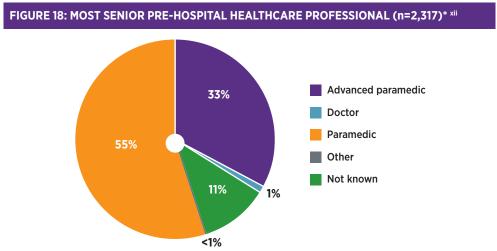
^{*} Patients who were transferred to another hospital are excluded. Data on patients whose mode of transport to hospital was 'Other' or 'unknown' are not presented above.e.

MOST SENIOR PRE-HOSPITAL HEALTHCARE PROFESSIONAL

Data capture relating to the pre-hospital part of the trauma patient's journey has been challenging for major trauma audit; the National Ambulance Service is currently moving to an electronic patient care record that is expected to facilitate audit.

FINDINGS

Of those major trauma patients attended to by a pre-hospital professional (n=2,317), 33% (n=760) were attended to by an advanced paramedic, (Figure 18).

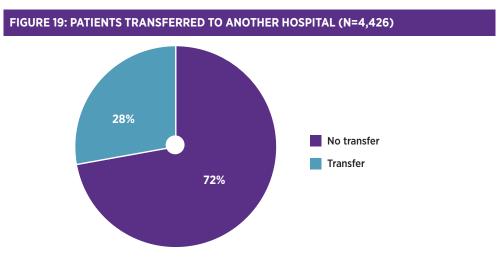


^{*} Only direct admissions by either ambulance or helicopter are included.

TRANSFER OF PATIENTS

FINDINGS

A fundamental principle in healthcare is getting the 'right patient to the right service at the right time' to optimise the outcome for that patient. In 2016, 28% (n=1,232) of patients were transferred at least once to another hospital for further care, (Figure 19). It is anticipated that the development of an integrated trauma system for Ireland, comprising major trauma centres and trauma units organised in networks, will reduce the number of patients who will need subsequent transfer for definitive care, as more patients will be transported directly to the 'right' hospital, and where transfer is required, it will be a more streamlined process.



xii Please note: Percentages may not sum to 100% due to rounding.

TRAUMATIC BRAIN INJURY AND ADMISSIONS TO A NEUROSURGICAL UNIT

FINDINGS

One thousand patients were recorded as having a significant TBI (AIS 3+, all GCS), (Figure 20). Of these, 11% (n=111) were admitted directly to a neurosurgical unit. A further 25% (n=245) were subsequently transferred to a neurosurgical unit.

There were 155 patients with a severe TBI (AIS3+, GCS<8), of those, 11% (n=17) were admitted directly to a neurosurgical unit, 44% (n=68) were transferred to a neurosurgical unit from another hospital and 45% (n=70) were not transferred, (Figure 20A). Research into the reason for these patients not being transferred to a neurosurgical unit is ongoing.

FIGURE 20: CARE PATHWAY OF PATIENTS WITH TBI (n=1,000)

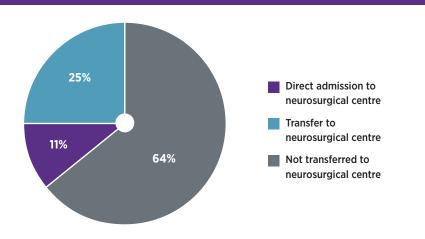
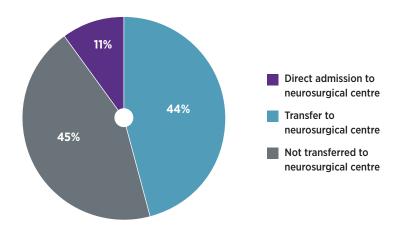


FIGURE 20A: SEVERE TBI AND ADMISSIONS TO A NEUROSURGICAL UNIT (n=155)





CARE OF MAJOR TRAUMA PATIENTS IN THE ACUTE HOSPITAL SERVICE

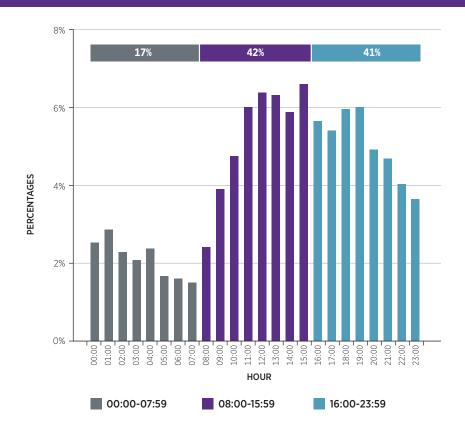
Reception, reconstruction and rehabilitation are key process measures in MTA that contribute to patient outcomes.

PRESENTATION BY TIME OF DAY

FINDINGS

There is very little variation in the rate of presentation of major trauma patients by day of week or month of year. However 58% of patients arrive between 4pm and 8am, and this is unchanged from the previous report, (Figure 21).

FIGURE 21: PRESENTATION BY TIME OF DAY (n=4,409)*



^{*} Patients with missing information on timepoint of admission (n=17) are excluded.

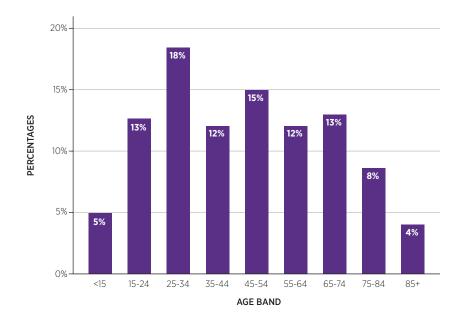
PRE-ALERT

Pre-alert is the system whereby the ambulance service communicates to the receiving hospital that it is bringing a patient to the emergency department, the nature of the patients injuries, the patient's physiology, their expected requirements on arrival and an expected arrival time.

FINDINGS

This analysis includes major trauma patients who were admitted by ambulance or helicopter directly to hospital and not transferred subsequently to another hospital. A very low percentage of patients are documented as having been pre-alerted (9%, n=207/2,317). Figure 22 shows the proportion of patients who were pre-alerted, by age band. There is a significant difference in the proportion of patients aged 65 years and over being pre-alerted compared to those aged 64 years and younger (p<0.05). Those aged 65 years and over are less likely to be pre-alerted.

FIGURE 22: PRE-ALERTED, BY AGE BAND (n=207)



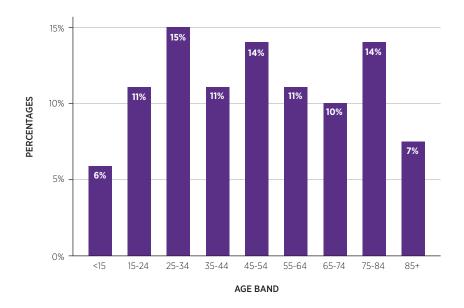
RECEPTION BY A TRAUMA TEAM

Outcomes from the initial assessment and resuscitation of trauma patients is improved by an organised trauma team (Driscoll and Vincent, 1992). The NHS Clinical Advisory Group (2010) recommended that trauma teams in major trauma centres should be led by a consultant and by an experienced registrar at trauma units. In Ireland, the lack of clear national standards on what should constitute a trauma team or when such a team should be activated makes this challenging to measure. Currently, it is up to participating hospitals to define their trauma team and report if this definition of a trauma team was activated.

FINDINGS

This analysis includes major trauma patients who were admitted directly to hospital and not transferred subsequently to another hospital. Only 8% (n=271) of trauma patients were assessed by a trauma team. Those aged under 15 years and over 85 years were less likely to be treated by a trauma team, (Figure 23).

FIGURE 23: RECEPTION BY A TRAUMA TEAM BY AGE BAND (n=271) xiii



xiii Please note: Percentages may not sum to 100% due to rounding.

RECEPTION BY A TRAUMA TEAM

FINDINGS

The overall percentage of major trauma patients received by a trauma team remains low at 8% (n=271) (Table 5). This is comparable with the data in the previous report.

TABLE 5: RECEPTION BY A TRAUMA TEAM		
	2016	
All patients received by a trauma team	8% (n=271 / 3,194)	
Trauma team led by a consultant (at 30 minutes)	35% (n=94 / 271)	
All severely injured patients (ISS>15) received by a trauma team	15% (n=130 / 895)	
Severely injured patients (ISS>15): Trauma Team led by a a consultant (at 30 minutes)	51% (n=66 / 130)	

FINDINGS

Patients aged 65 years and older were significantly (p<0.05) less likely to be reviewed by a senior clinician compared to those under the age of 65 years, (Figure 24). Eight per cent (n=256) of patients were seen by a consultant within 30 minutes of arrival in ED, (Table 6).

FIGURE 24: GRADE OF MOST SENIOR DOCTOR TREATING PATIENT ON ARRIVAL, BY AGE BAND (n=3,194) $^{\rm xiv}$

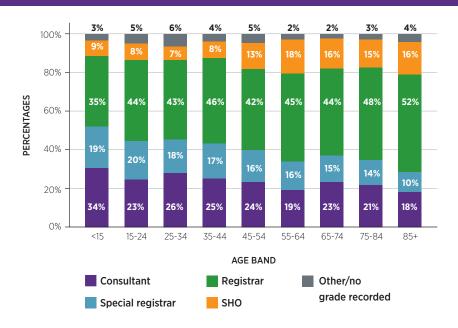


TABLE 6: MOST SENIOR DOCTOR SEEING THE PATIENT IN THE ED AND THOSE WITH ISS>15*

	Most senior doctor seeing patient on arrival in ED <30mins (n=3,194)	Most senior doctor seeing patient in ED after arrival (n=3,194)	Most senior doctor seeing patient on arrival with ISS>15 in ED <30mins (n=895)	Most senior doctor seeing patient in with ISS>15 in ED after arrival (n=895)
Consultant	256 (8%)	706 (22%)	140 (16%)	284 (32%)
Associate specialist	0 (-)	3 (<1%)	0 (-)	0 (-)
Specialist registrar	1 (<1%)	491 (15%)	0 (-)	168 (19%)
Registrar	201 (6%)	1,451 (45%)	92 (10%)	349 (39%)
SHO	632 (20%)	433 (14%)	190 (21%)	75 (8%)
Intern	194 (6%)	2 (<1%)	38 (4%)	0 (-)
Other (not recorded)	23 (1%)	27 (1%)	4 (<1%)	4 (<1%)
Detail not captured at timepoint	1,887 (59%)	81 (3%)	431 (48%)	15 (2%)

^{*} Patients who were transferred to another hospital are excluded.

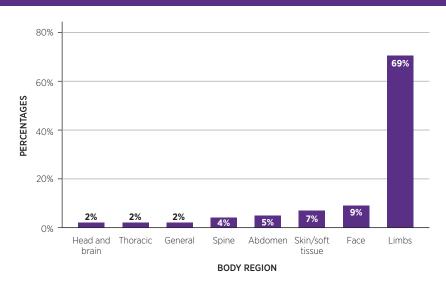
xiv Please note: Percentages may not sum to 100% due to rounding.

SURGERY

FINDINGS

Of the 1,219 surgeries performed, over two-thirds (69%, n=847) were performed on a limb or limbs, (Figure 25). Surgery was performed on 33% (n=450) of all severely injured (ISS>15) patients (n=1,347).

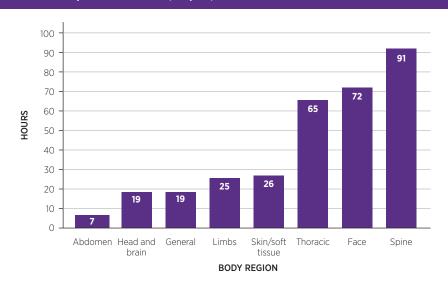
FIGURE 25: SURGICAL INTERVENTION BY BODY REGION (n=1,219)*



FINDINGS

Figure 26 shows the median time in hours to surgery, by body region. This is surgery that occurred at any point during admission. Table 10 shows the median time to surgery, by body region and age band (see Appendix 5).

FIGURE 26: MEDIAN TIME (IN HOURS) TO SURGERY FOR PATIENTS HAVING SURGICAL INTERVENTION, BY BODY AREA (n=1,195)*†



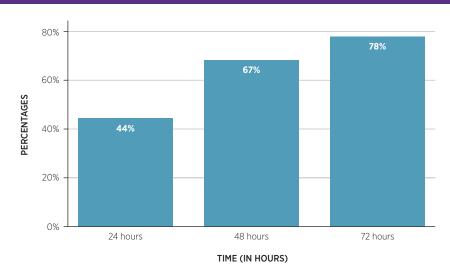
^{*} Patients that were transferred to another hospital are excluded.

 $^{^{\}dagger}$ Patients with missing information on timepoint of surgery (n=24) are excluded.

FINDINGS

Seventy-eight percent (n=936) of surgeries were carried out within 72 hours of admission (Figure 27).

FIGURE 27: PERCENTAGE OF SURGERY WITHIN 24, 48 AND 72 HOURS (n=1,195)**



^{*} Patients with missing information on timepoint of surgery (n=24) are excluded.

[†] Patients who were transferred to another hospital are excluded.

HOSPITAL SYSTEMS PERFORMANCE

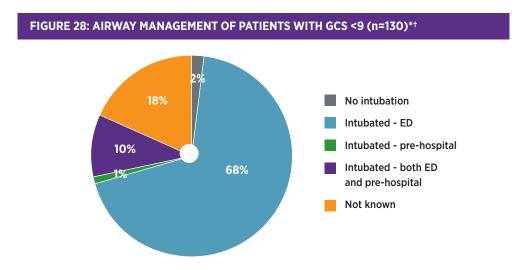
The TARN audit is underpinned by clinical standards and systems indicators, which are intended to provide opportunities for learning and improvement.

1. PATIENTS WITH GCS <9 PRE-HOSPITAL OR IN THE ED HAVE DEFINITIVE AIRWAY MANAGEMENT PRE-HOSPITAL OR IN THE ED

International guidelines use a GCS of <9 as a criterion for the requirement of definitive airway management, i.e. endotracheal or tracheal intubation on arrival to an ED (Royal College of Surgeons in England, 1999).

FINDINGS

There were 130 patients with a recorded GCS of <9. Of these, 70% (n=103) were intubated, (Figure 28).



 $^{^{*}}$ There are patients with a GCS<9 on presentation who may not require intubation due to their condition improving, intoxication, not-for-resuscitation (NFR) status, etc.

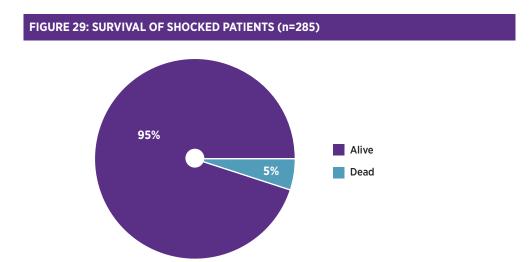
[†] Calculations for this Figure relate to the first hospital a trauma patient was received in.

2. MANAGEMENT OF SHOCKED PATIENTS

Patients with blunt trauma admitted with a systolic blood pressure of less than 110mmHg have a significant increased risk of mortality (Hassler *et al.*, 2011). The 'crude survival' does not attempt to adjust for differences in age, gender, comorbidities, etc. which can contribute to survival.

FINDINGS

A total of 285 shocked patients were recorded (representing 6% of MTA patients). Of those, 95% (n=271) survived and 5% (n=14) died, Figure 29.



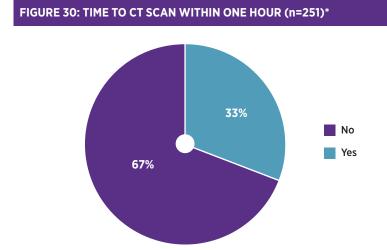
3. TIME TO CT FOR HEAD INJURY PATIENTS

Injured patients with head injuries and an initial GCS of <13 should have a CT head scan within one hour (NICE, 2014). There were 251 patients who required a CT (having head injuries and an initial GCS of < 13) but only 33% (n=82) of patients received within one hour, (Figure 30).

There was no difference in time to CT across the week.

FINDINGS

The median time to CT scan for head injury patients with GCS of <13 was 1.3 hours (IQR 0.9-2.3 hours).



^{*} Patients with missing information on timepoint of CT scan (n=10) are excluded.

4. INTENSIVE CARE UNIT ADMISSION

In Ireland, the modern Intensive Care Unit (ICU) or High Dependency Unit (HDU), where critically ill patients receive critical care, is described as a critical care service by the Joint Faculty of Intensive Care Medicine of Ireland (JFICMI) 'National Standards for Adult Critical Care Services 2011'.

Critical care encompasses both Intensive care and high dependency care. In practice, level 2 is high dependency (HDU) and level 3 is intensive care (ICU) level of critical care. critical care units provide life-sustaining treatment for critically ill patients with acute organ dysfunction due to potentially reversible disease. It is the purpose of the Unit to support the patient's failing organs and diagnose and treat the underlying cause. Patients at risk of organ dysfunction due to chronic disease processes or other temporary reversible circumstance (e.g. after trauma), may also benefit from critical care in the perioperative period.

Patients sustaining major trauma are admitted to an intensive care unit for many reasons including ongoing resuscitation, organ support and/or closer monitoring. The length of stay (LOS) in an ICU can be influenced by the availability of ICU beds, the needs of the patient and/or the availability of step down beds.

Table 7 shows that 17% (n= 758) of MTA patients were admitted to an ICU, with a median length of stay in the unit of three days for all patients. The MTA should be used to inform national ICU bed capacity requirements.

TABLE 7: ICU LOS					
	ICU LOS FOR ALL MTA PATIENTS	ICU LOS FOR MTA PATIENTS ISS>15	ICU LOS FOR MTA PATIENTS WITH SEVERE TBI		
N	758	478	120		
Median (IQR)	3 (1-8)	4 (2-9)	5 (1-12)		
ICU bed days	4,843	3,713	911		

5. HOSPITAL LENGTH OF STAY

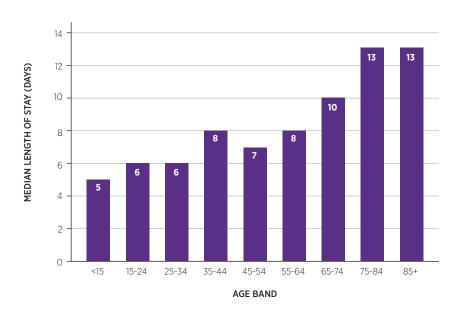
LOS for major trauma patients if ISS>15

Hospital length of stay for trauma patients is dependent on the nature and severity of the injuries sustained, the baseline health of the patient, the efficiency of the hospital in delivering care and the ability of the hospital to discharge the patient to an appropriate setting when they have recovered. Access to rehabilitation, step-down facilities, and home and community supports influence the length of stay at the acute hospital for severely injured patients. The median length of stay for all major trauma patients was nine days, (Table 8). Figure 31 shows the median LOS for major trauma patients by age band.

TABLE 8: HOSPITAL LOS FOR MAJOR TRAUMA PATIENTS LOS for all major trauma patients Median (IQR) 9 (5-17)

Median (IQR) 10 (5-22)

FIGURE 31: HOSPITAL LENGTH OF STAY BY AGE BAND (N=4,426)



CHAPTER 6 OUTCOMES FOLLOWING MAJOR TRAUMA



OUTCOMES FOLLOWING MAJOR TRAUMA

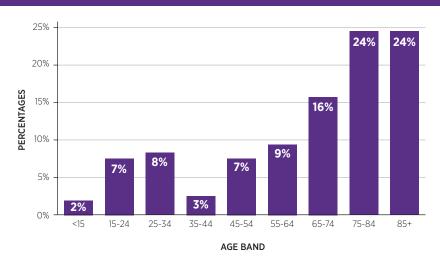
MORTALITY

Mortality is a crude measure of quality of care in major trauma patients. Ninety-six per cent (n=4,233) of MTA patients survived while 4% (n=193) were recorded as having died during their hospital admission.

FINDINGS

The highest proportion of deaths occurred in patients who were aged 75 years and over, (Figure 32).



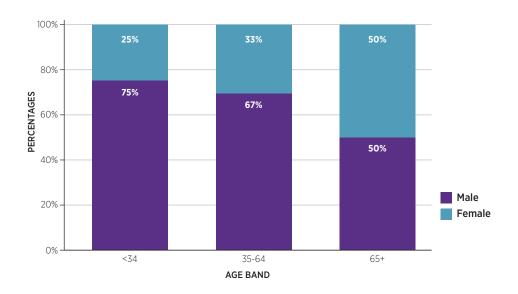


In Figure 33, Figure 34A and Figure 36, age band have been condensed into three bands so that there are sufficient numbers in each band for comparison purposes.

FINDINGS

Figure 33 shows the percentage of deaths by age band and gender. The highest percentage of deaths occurred in males.

FIGURE 33: MORTALITY BY GENDER AND AGE BAND (n=193)

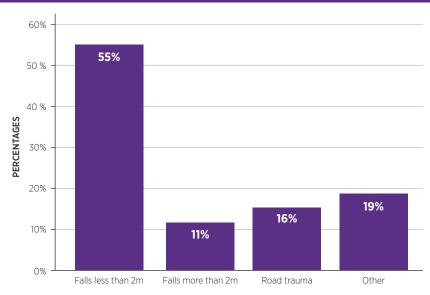


MORTALITY BY CAUSE OF INJURY

FINDINGS

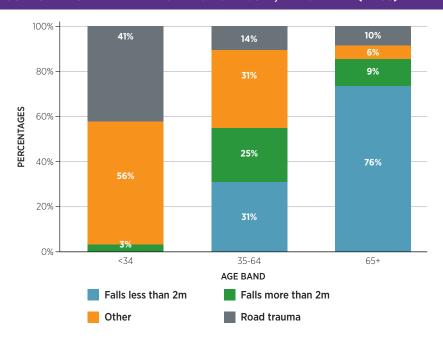
The highest proportion of deaths is attributable to falls less than 2 metres (55%) (Figure 34). Figure 34A shows that the leading cause of mortality in major trauma patients aged under 34 is attributable to 'other' (56%) (other may refer to asphyxiation / drowning / and amputation). In patients aged 65 and over, the leading cause of mortality is 'low falls' (76%).





MECHANISM OF INJURY

FIGURE 34A: MORTALITY BY MECHANISM OF INJURY, BY AGE BAND (n=193) **

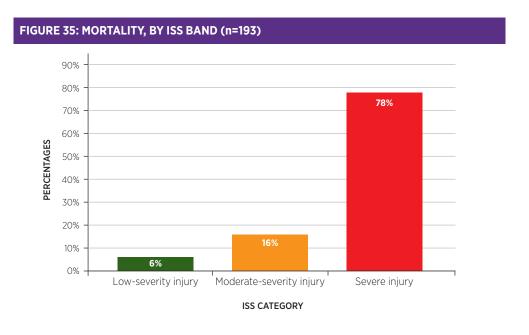


Please note: Percentages may not sum to 100% due to rounding.

MORTALITY BY ISS BAND

FINDINGS

Of those patients who died, 78% (n=151) had an ISS of greater than 15, indicating severe trauma, (Figure 35).

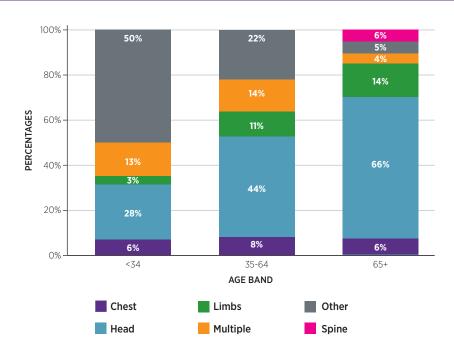


MORTALITY, BY BODY REGION

FINDINGS

Figure 36 shows that head injuries were the predominant cause of death for those aged 65 years and over (66%).

FIGURE 36: MAJOR TRAUMA DEATHS BY BODY AREA INJURED, BY AGE BAND (n=193) xvi



 $^{^{\}mbox{\tiny {\rm XVI}}}$ Please note: Percentages may not sum to 100% due to rounding.

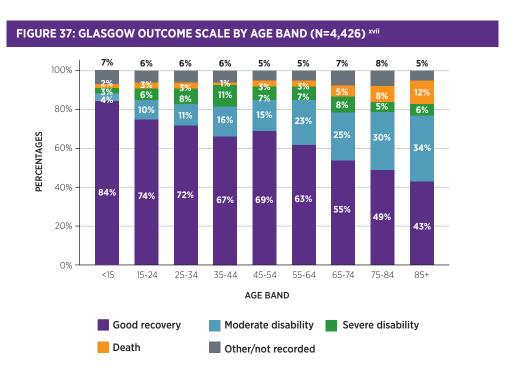
GLASGOW OUTCOME SCALE AT DISCHARGE

The Glasgow Outcome Scale (Jennett *et al.*, 1981) applies to patients with a brain injury and allows an assessment of their recovery in five categories ranging from 'death' to 'good recovery with resumption of normal activities' although there may be minor neurological or psychological deficits.

FINDINGS

Older patients (75-84 and 85+ years age bands) have higher levels of disability and mortality than younger patients following major trauma (p<0.05) across all injuries (Figure 37).

More patients in the 75–84 and the 85+ age bands with head injury (Figure 37A) and severe injury (Figure 37B) died following trauma than patients in other age bands. More patients with head injury (Figure 37A) and severe injury (Figure 37B) were discharged with severe disability in the 15-74years age bands, with the greatest presentation in the 35-44 age band. More paediatric patients (< 15 years age band) made a good recovery across all injuries (Figure 37), head injuries (Figure 37A) and severe injuries (Figure 37B).



xvii Please note: Percentages may not sum to 100% due to rounding.

FIGURE 37A: GLASGOW OUTCOME SCALE IN PATIENTS WITH HEAD INJURY BY AGE BAND (n=1,161) $^{\mbox{\tiny XVIII}}$

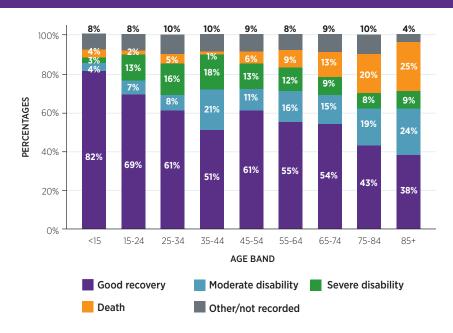
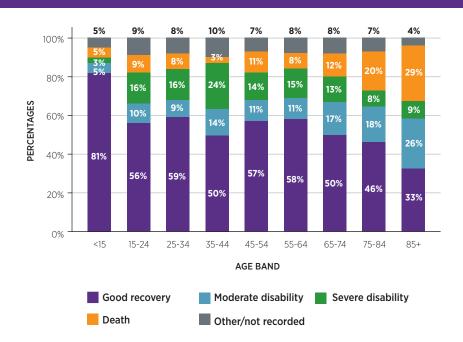


FIGURE 37B: GLASGOW OUTCOME SCALE IN PATIENTS WITH ISS >15 BY AGE BAND (n=1,374) $^{\mathrm{xviii}}$



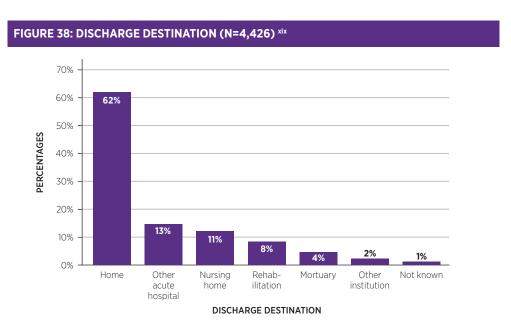
 $^{^{\}mbox{\tiny xviii}}$ Please note: Percentages may not sum to 100% due to rounding.

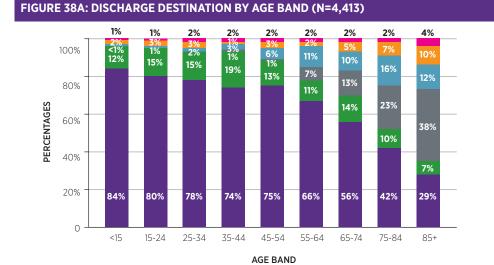
DISCHARGE DESTINATION

FINDINGS

Over half of major trauma patients were discharged directly home (62%, n=2,732). An additional 11% (n=475) were discharged to a nursing home and 8% (n=353) were discharged to a rehabilitation setting (Figure 38).

Younger patients are more likely to be discharged home. A higher proportion of older patients were discharged to either a rehabilitation setting or long-term care compared to younger patients (Figure 38A).





Nursing home

Other acute hospital Rehabilitation

 $^{ ext{xix}}$ Please note: Percentages may not sum to 100% due to rounding.

Home

Mortuary/not known

Other Institution

RISK-ADJUSTED BENCHMARKING: CASE MIX STANDARDISED RATE OF SURVIVAL FOR IRELAND, 2016

TABLE 9: PROBABILITY OF SURVIVAL (PS)*

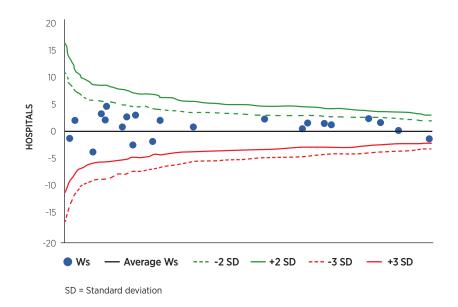
PS Band	n	Survivors	Expected Survivors	W	TARN Fraction	Ws	95% CI
95 - 100	2,998	2,979	2,959.36	0.66	0.67	0.44	
90 - 95	541	518	503.18	2.74	0.16	0.43	
80 - 90	274	252	235.21	6.13	0.08	0.52	
65 - 80	134	100	98.45	1.16	0.04	0.04	
45 - 65	59	36	32.50	5.93	0.02	0.13	
25 - 45	46	14	16.87	-6.23	0.02	-0.10	
0 - 25	33	3	4.47	-4.46	0.01	-0.06	
Total	4,085	3,902	3,850.04	1.27		1.40	(0.67-2.13)

^{*} Only cases with a known outcome are eligible for this calculation (cases that are transferred out for further care where the matching submission hasn't been received are excluded) so the total will be less than the overall number of cases in the dataset.

Risk adjustment is a process that allows data to be compared, adjusting for confounding factors (i.e. age, gender, severity of injury, pre-existing comorbidities and GCS) that influence the outcome. Within TARN, this is done at an individual patient level as well as at a hospital level. From approved TARN submissions, a risk-adjusted survival rate is calculated for Ireland for 2016. This is based on all approved submissions from participating hospitals and is adjusted for case mix. This is referred to as the Ws value. Ireland's Ws value of 1.4 (95% confidence interval 0.67 - 2.13) (Table 9) means that for every 100 major trauma patients treated in Ireland there are 1.4 more survivors than the TARN statistical model predicts (Bouamra *et al.*, 2015). With overall data completeness at 74% for 2016, the Ws value for Ireland should therefore not be over-interpreted.

The hospital Ws score is calculated where there are over 50 approved TARN submissions, but becomes more reliable with over 200 approved submissions. In 2016, 22 hospitals with more than 50 approved submissions were included. The number of discharges ranged from 50 to 448 per hospital, with 16 hospitals having less than 200 approved submissions, Figure 39.

FIGURE 39: IRISH HOSPITAL WS SCORES, 2016



Risk-adjusted survival does not take account of the potential high personal and societal costs when patients are delayed or prevented from returning to their pre-trauma functional status or quality-of-life. Functional and quality of life patient outcomes should be incorporated into major trauma audit. In Victoria, Australia, a structured telephone questionnaire is used to measure functional and quality of life outcomes at six, 12 and 24 months. Information about functional ability and health-related quality of life is collected during the interviews (Department of Health and Human Services (State of Victoria, Australia), 2016).



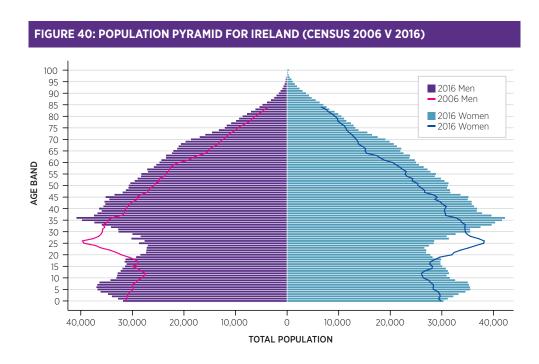
MAJOR TRAUMA IN OLDER PEOPLE

This chapter focuses on major trauma in older patients. Emerging evidence shows that the proportion of major trauma victims who are in the older age bands is rapidly increasing and the most common mechanism of injury is now 'low falls' (Fisher, Bates and Banerjee, 2017). The MTA 2016 National Report corroborates this evidence, showing that older patients (aged 65 years and older) now represent a large cohort of MTA patients (40%). 'Low falls' was the major cause of injury in patients aged 65 years and older in this report. The majority of incidents happened in the patient's home. Advanced age correlates with higher numbers of comorbidities, frailty and dementia, making management of older major trauma patients more complex and difficult. The leading cause of death in major trauma patients aged 64 years and under is road trauma and in those aged 65 years and over it is 'low falls'. Older patients are more likely to die or to suffer higher levels of disability than younger major trauma patients with a similar Injury Severity Score (ISS). Older patients are less likely to be reviewed by a senior clinician.

Major trauma in older people is becoming increasingly recognised as a significant challenge to modern healthcare systems. Kehoe *et al* (2015) demonstrated an increase in the mean age of trauma patients from 36.1 years in 1990 to 53.8 years in 2013. There was also a three-fold increase in the proportion of major trauma accounted for by individuals aged over 75 years, from 8.1% in 1990 to 26.9% in 2013.

In Ireland, the average life expectancy is 81.4 years (WHO, 2011). The population aged over 65 years has increased by 19.1% since 2011. This is especially evident in the male population which rose by 53,523 (22%) to 296,837 compared with an increase of 48,651 (16.7%) to 340,730 for females. For the population aged over 85 years, the male population increased by 24.8% to 23,062, whereas the female population increased by 11.4% to 44,493 (CSO, 2016) in the same period.

Figure 40 illustrate the number of men and women for each age band in 2016, and the blue and purple lines illustrate the number of men and women for each age band in

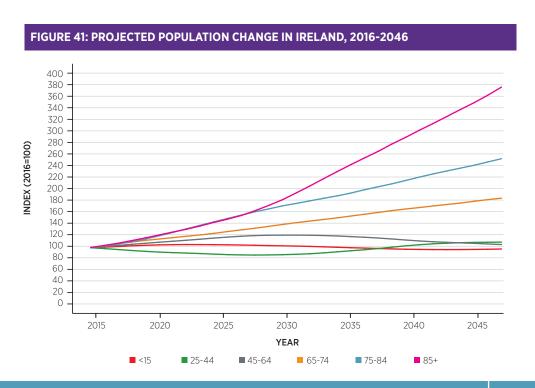


2006. These population counts have been conducted by the Central Statistics Office (CSO) based on the Census 2016 and 2006. The total population consisted of 4.8 million people in 2016, which is 12.3% more people than the 4.2 million in 2006. The traditional age pyramid pattern is clearly apparent for the age bands over 35 years (there are fewer people in the older age bands). The age groups below 35 years have fewer individuals, with fewest individuals aged between 20 and 25 years. There is a small peak in the five- to-eight-year-old groups, but these age bands are considerably smaller than the largest group of 35 year olds.

Figure 40 shows that the 2016 population distribution has shifted by 10 years from the 2006 population, with the most noticeable difference being the peak in the five-to-eight-year-old groups. The number of people aged over 85 years increased by 41% during the decade.

The CSO have developed eight scenarios for future population development. Data from the scenario considered to be most likely (M2F2) are presented in Figure 41, which shows the projected change in different age bands during the next 30 years. For ease of interpretation, the 2016 population has been standardised to index=100. An index of 120 thus indicates that there is expected to be 20% more people in an age band in comparison with the 2016 population.

Figure 41 illustrates that the number of people aged over 65 years is expected to grow significantly. During the next decade, the age group between 65-74 is expected to grow by 28%, while 75-84 and 85+ age bands are expected to grow by 50%. In absolute numbers, this means that the number of people aged over 75 years will increase from 261,000 to 391,000 persons. These growth expectations continue during the 30-year period shown; by 2036 the 65-74 age band is expected to grow by 58% (from 363,000 to 572,000), and the 75-84 and 85+ age bands are expected to grow by 100% (from 191,000 to 381,000) and 150% (from 70,000 to 178,000) respectively.



Age increases the likelihood of falls due to physiologic changes of ageing, decreases in bone mass, balance, reaction time and an increase in frailty and comorbidities. Advancing age plays a big role in the mechanism of injury which is most commonly a fall from less than 2 metres. Location of injury and processes around the timeliness of assessment, interventions and ultimately outcomes may also be influenced by age and the risk of serious injury also increases. Many older patients do not return to their previous functional status following even moderate trauma. Problems particular to older patients include diminished respiratory and cardiovascular reserve, frailty, pre-existing comorbidities and medications.

It is clearly shown in this report that older major trauma patients represent a challenge in terms of their comorbidities, in addition to the trauma they have suffered. No older person should be considered 'just trauma'. Older people compensate for changes in aging but have limited physiologic reserve if they become unwell due to stress, trauma or illness. Post-trauma mortality is increased in older patients. Clement, Tennant and Muwanga (2010) have shown an inpatient mortality ranging from 5.2% to 11.3% in those aged 65 years and over compared to 2.3% to 7.2% in those aged under 65 years. A study by Bouamra *et al.* (2015) showed that age and comorbidities independently affect outcome.

In 2010, the Royal College of Physicians of Ireland in partnership with Health Services Executive set up the National Clinical Programme for Older Persons (NCPOP) in Ireland. This clinically led group developed and published 'Specialist Geriatric Services Model of Care, Part 1: Acute Service Provision' in 2012 (HSE and RCPI, 2012). The model of care published in 2012 is a key component in the care journey for older people and recommends that older people should have access, if required, to the following services in secondary care (medical or surgical need): dedicated in-patient specialist geriatric wards (SGW), specialist geriatric teams (SGT), a comprehensive geriatric assessment (CGA) for all those identified as frail, at risk or in the older age bracket. This is to ensure that their individual needs are fully assessed and that they have access to the services they require, such as in-patient rehabilitation facilities, ambulatory day hospital services and improved links with community-based services (residential care and home supports) (HSE and RCPI, 2016).

CGA is fundamental to the assessment, planning and intervention required to meet the health and social care needs of the older person who is frail, at risk of frailty, or is recovering from medical illness or surgery. Rather than the traditional way of working separately, CGA facilitates nurses, physiotherapists, occupational therapists, social workers, doctors and other members of the team to work closely together to ensure an integrated assessment and response to the older person's individual needs. With adequate resources, this can be available to an older person in the community or in the hospital. CGA has the potential to improve the care people receive in hospital and to reduce unnecessary hospital admissions, lengths of stay and re-admissions (Ellis *et al.*, 2011).

Healthcare has progressed so much over the past number of decades. Advanced imaging also allows detection of previous occult injuries. Surgical intervention and treatments are much more widely available to older patients. Hip fracture registries including the Irish Hip Fracture Database (IHFD) have demonstrated that collaborative care between orthopaedic surgery and geriatric medicine specialists can significantly

improve care processes and outcomes for older patients. This approach now needs to extend to patients who suffer major trauma.

Older major trauma patients present a unique challenge as they do not raise the same clinical flags as younger patients and a critical early step in the management of major trauma is the recognition that a patient has potentially sustained major trauma. Physiologically, older patients show misleading parameters when triaged, for example presenting GCS is higher in older patients or for patients with intracranial injuries (Kehoe et al., 2016). To use haemodynamic status as a predictor of mortality in older patients who suffer blunt-force trauma is less predictable (Heffernan et al., 2009). Pre-existing comorbidities and medications can alter a patients expected response to shock, pain and hypoxia and the result is an under-triage of older patient's with major trauma. Currently, many standard triage criteria have poor sensitivity in identifying severe injuries in older patients (Ichwan et al., 2015). Early identification of injuries in older people may lead to better and more timely decision making, earlier access to treatment and a more co-ordinated period of recovery and rehabilitation and ultimately reduced length of stay and complications.

We need an age-attuned healthcare system fit to care for the biggest proportion of healthcare services users: older patients. Older patients are more vulnerable to suffering harm and complications from either overly intensive or delayed management and there is a challenge to get this balance right in order to prevent avoidable harm. The reduction and prevention of fails and fractures involves CGA and intervention, coupled with effective bone health prevention and treatment.

Collaboration in a manner similar to some orthogeriatric models would enhance our ability to select a high-risk group of patients, who require more intensive post-trauma management, early in the course of their presentation. This would decrease complications and reduce mortality in this group. Targeted rehabilitation on a dedicated trauma / rehabilitation unit would lead to improved outcomes similar to those seen in orthopaedic units with embedded orthogeriatric services and stroke units. In addition, our ability to understand, recognise, identify and manage frailty in older people through multidisciplinary team work will be increasingly important in delivering improved outcomes for patients. Trauma networks should ensure that geriatricians are involved in the development and or review of local elderly trauma policies and guidance.

This report highlights the following for consideration in relation to older patients suffering major trauma:

- Forty per cent (n=1,770) of major trauma patients are aged 65 years and older.
- The main mechanism of injury was 'low falls' in older age bands.
- Advanced age correlates with higher numbers of comorbidities, making the clinical management of older major trauma patients more complex and difficult.
- Patients aged 65 years and older were less likely than those aged 64 years and under to be pre-alerted or received by a trauma team.
- Older patients (age 65 years and older) are less likely to be reviewed by senior clinicians compared to major trauma patients aged 64 years and younger.
- Older patients are more likely to die and suffer higher levels of disability than younger major trauma patients with a similar Injury Severity Score (ISS).

CHAPTER 8 MTA QUALITY IMPROVEMENT INITIATIVES





MTA QUALITY IMPROVEMENT INITIATIVES

Quality improvement is: "the combined and unceasing efforts of everyone - healthcare professionals, patients and their families, researchers, payers, planners and educators - to make the changes that will lead to: better patient outcomes, better systems performance and better professional development (Batalden and Davidoff, 2007)". A prerequisite for engagement in the MTA, through NOCA, by hospitals in Ireland was that they would have a trauma governance committee, comprised of key stakeholders in trauma care in their hospital to ensure audit findings from were acted upon.

NOCA, as the national audit body for major trauma in Ireland, is encouraged that local hospitals use their data from the MTA to measure their care and drive improvements in that care.

Below are examples of some QI initiatives and projects that have taken place.

CAVAN GENERAL HOSPITAL

Cavan General Hospital's major trauma documentation for the ED was reviewed and updated by the local trauma group to include documentation of:

- Prompt to involve St James's Hospital, Our Lady's Children's Hospital Crumlin and Mater Misericordiae University Hospital for certain complex haematological conditions.
- Charts were developed for quick documentation of burns and lacerations.
- · Checklist for removal of drains/tubes.
- Coroner checklist.
- The procurement of additional equipment for ED including: End Tidal Co2 monitor and a pneumatic tourniquet.

RESULTS: The new documentation has improved the recording of vital information and acts as a prompt for staff. Monthly meetings are held with the ED multidisciplinary team in conjunction with the radiologists to perform an in-depth analysis of cases.

CORK UNIVERSITY HOSPITAL

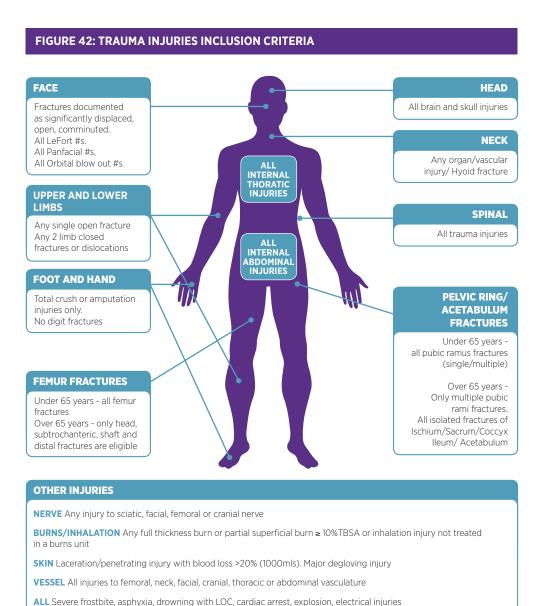
Using major trauma data locally, several projects were undertaken around the following aspects of care:

- Review of all plastics patients including burns from 2013-2015.
- Review of trauma patients who were admitted to ICU.
- Review of the care pathway of patients with a TBI from time of injury to discharge.
- Review of CT scanning for trauma patients- data from October 2013-2015 compared for pre-and post-introduction of a CT protocol.
- Review of CT features of hypovolaemia, using patients identified by TARN.

MATER MISERICORDIAE UNIVERSITY HOSPITAL

Considerable work has been done to maximise the use of existing ICT system to meet the demands of trauma care provision, data capture and audit.

A poster was adapted from Furness General Hospital, Cumbria England and displayed in key locations within the hospital to raise awareness of the types of injuries that are captured in TARN. Education was provided locally to staff by the MTA data coordinator. A designated icon has been added to the hospitals Flow System identifying major trauma patients.



MTA QUALITY INITIATIVES

ST. JAMES'S HOSPITAL

A project was undertaken in St. James's Hospital to develop a standard approach to trauma documentation in line with TARN:

- A trauma clinical proforma was developed, implemented and piloted at St James's Hospital and subsequently at Cork University Hospital.
- Baseline data from the clinical working report on St James's Hospital data highlighted some inadequacies in documentation.
- The trauma proforma was re-engineered as a decision support documentation tool to optimise critical actions and documentation and refined through iterative PDSA (Plan, Do, Study, Act) cycles.
- Introduction of the tool has been associated with improved data capture. It is
 envisaged that this trauma decision support and documentation tool could be
 adapted by each Emergency Department in Ireland. Engagement with NOCA
 (National Office of Clinical Audit) and the IAEM (Irish Association for Emergency
 Medicine) Guidelines Committee to nationalise the document is ongoing.



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APPENDIX 1: INCLUSION CRITERIA

The decision to include a patient should be based on the following 3 points:

- 1. ALL TRAUMA PATIENTS IRRESPECTIVE OF AGE
- 2. WHO FULFIL ONE OF THE FOLLOWING LENGTH OF STAY CRITERIA

DIRECT ADMISSIONS	PATIENTS TRANSFERRED IN
Trauma admissions whose length of stay is 3 days or more OR Trauma patients admitted to a High Dependency Area regardless of length of stay OR Deaths of trauma patients occurring in the hospital including the Emergency Department (even if the cause of death is medical) OR Trauma patients transferred to other hospital for specialist care or for an ICU/HDU bed.	Trauma patients transferred into your hospital for specialist care or ICU/HDU bed whose combined hospital stay at both sites is 3 days or more OR Trauma admissions to a ICU/HDU area regardless of length of stay OR Trauma patients who die from their injuries (even if the cause of death is medical) Patients transferred in for rehabilitation only should not be submitted to TARN.

3. AND WHOSE ISOLATED INJURIES MEET THE FOLLOWING CRITERIA

BODY REGION OR SPECIFIC INJURY	INCLUDED - IN ISOLATION (EXCEPT WHERE SPECIFIED)	EXCLUDED - IN ISOLATION (EXCEPT WHERE SPECIFIED)
HEAD	All brain or skull injuries	LOC or injuries to scalp
THORAX	All internal injuries	
ABDOMEN	All internal injuries	
SPINE	Cord injury, fracture, dislocation or nerve root injury.	Spinal strain or sprain.
FACE	Fractures documented as: Significantly Displaced, open, compound or comminuted. All Lefort fractures All panfacial fractures. All Orbital Blowout fractures	Fractures documented as Closed and simple or stable.
NECK	Any Organ or vascular injury or hyoid fracture	Nerve Injuries Skin Injuries
FEMORAL FRACTURE	All Shaft, Distal, Head or Subtrochanteric fractures, regardless of Age. Isolated Neck of Femur or Inter/ Greater trochanteric fractures <65 years old	Isolated Neck of femur or Inter/Greater trochanteric fractures ≥ 65 years.
FOOT OR HAND: JOINT OR BONE	Crush or amputation only.	Any fractures &/or dislocations, even if Open &/or multiple
FINGER OR TOE	None	All injuries to digits, even if Open fractures, amputation or crush &/or multiple injuries.

BODY REGION OR SPECIFIC INJURY	INCLUDED - IN ISOLATION (EXCEPT WHERE SPECIFIED)	EXCLUDED - IN ISOLATION (EXCEPT WHERE SPECIFIED)
LIMB – BELOW KNEE (EXCEPT FEET/TOES)	Any Open injury. Any 2 limb fractures &/or dislocations.	Any Closed unilateral injury fractures, (including multiple closed fractures & or dislocations or the same limb)
LIMB – BELOW KNEE (EXCEPT FEET/TOES)	Any Open injury. Any 2 limb fractures &/or dislocations.	Any Closed unilateral injury fractures, (including multiple closed fractures & or dislocations or the same limb)
PELVIS	All isolated fractures to Ischium, Sacrum, Coccyx, Ileum, acetabulum. Multiple pubic rami fractures. Single pubic rami fracture <65 years old. Any fracture involving SIJ or Symphysis pubis.	Single pubic rami fracture >65 years old.
NERVE	Any injury to sciatic, facial, femoral or cranial nerve.	All other nerve injuries, single or multiple.
VESSEL	All injuries to femoral, neck, facial, cranial, thoracic or abdominal vessels. Transection or major disruption of any other vessel.	Intimal tear or superficial laceration or perforation to any limb vessel.
SKIN	Laceration or penetrating skin injuries with blood loss >20% (1000mls) Major degloving injury. (>50% body region)	Simple skin lacerations or penetrating injuries with blood loss < 20% (1000mls); single or multiple. Contusions or abrasions: single or multiple. Minor degloving injury. (<50% body region)
BURN	Any full thickness burn or Partial/superficial burn >10% body surface area	Partial or superficial burn <10% body surface area.
INHALATION	All included	
FROSTBITE	Severe frostbite	Superficial frostbite
ASPHYXIA	All	None
DROWNING	All	None
EXPLOSION	All	None
HYPOTHERMIA	Accompanied by another TARN eligible injury	Hypothermia in isolation
ELECTRICAL	All	None

ANATOMICAL INJURY DESCRIPTIONS

INJURY DETAIL

Injury detail is of **paramount importance to any TARN submission**, therefore all injuries sustained by a patient must be recorded on every submission.

Information relating to injuries should be obtained from the following sources: clinician's notes, nursing notes, radiology reports, operative notes, discharge summaries and post mortem reports.

Guidelines to help with injury documentation, record:

- Length, depth or grade of lacerations (especially to internal organs)
- Depth, size and location of haemorrhages and contusions (especially in the brain)
- Open or closed fractures
- Stability & site of fractures (e.g. comminuted/displaced shaft/proximal/distal fracture)
- Articular (joint) involvement (e.g. intra-articular, extra-articular)
- · Blood loss
- Vessel damage
- Location & number of rib fractures
- Compression or effacement of ventricles/brain stem cisterns
- Neurology associated with spinal cord injuries
- Instability, blood loss, joint involvement or vascular damage associated with pelvic fractures
- · Cardiac arrest associated with asphyxia or drowning

UNCONFIRMED INJURIES

Injuries should only be recorded when the diagnosis is confirmed. Never record possible, probable or suspected injuries.

RADIOLOGY REPORTS AND POST-MORTEMS

The user should paste a radiology report into the relevant imaging section of any electronic data collection and reporting (EDCR) submission.

When a report is pasted into an EDCR submission, it will automatically appear on the AIS coding section, thus ensuring that the TARN coder has all the information in front of them before assigning AIS codes.

Post mortem results should be used whenever available even if this results in a delay in dispatching your submission.

All injury coding using AIS is done centrally at TARN, but users can see every AIS code issued by TARN by clicking into the AIS coding section once a submission has been approved.

Accurate and detailed injury descriptions will enable a more precise Injury Severity Score and therefore a more accurate Probability of Survival calculation.

ABBREVIATED INJURY SCALE (AIS)

BACKGROUND INFORMATION

A.I.S. was first published in 1969 by the Association for the Advancement of Automotive Medicine (A.A.A.M.). The latest edition (AIS2005) is now available from the AAAM website: www.AAAM..org at cost of \$250 per dictionary.

STRUCTURE

- Based on anatomical injury.
- A single AIS score for each injury.
- More than 1500 injuries listed.
- Scores range from 1 to 6, the higher the score the more severe the injury.
- The intervals between the scores are not always consistent e.g. the difference between AIS3 and AIS4 is not necessarily the same as the difference between AIS1 and AIS2.

EXAMPLE AIS CODES

INJURY	NUMERICAL IDENTIFIER	AIS	SEVERITY
Fracture 1 rib	450201	1	Minor
Fractured 2 ribs	450202	2	Moderate
Haemopneumothorax	442205	3	Serious
Bilateral lung lacerations	441450	4	Severe
Bilateral flail chest	450214	5	Critical
Massive chest crush	413000	6	Maximum

CODING STRUCTURE EXPLAINED

	DDY	TYPE OF ANATOMICAL STRUCTURE	SPECIFIC ANATOMICAL STRUCTURE		LEVEL	LEVEL
	4	5	0	2	0	2

AIS
2

All existing codes on the TARN database that were coded with AIS98 (previous version of Dictionary) were successfully mapped to corresponding AIS2005 codes, so continuing comparisons can be made.

APPENDIX 2: GLOSSARY

AIS	Abbreviated Injury Scale score. A value between 1 (minor) and 6 (very severe) can be assigned to each injury. TARN currently uses the AIS 2005 system Association for the Advancement of Automotive Medicine (2005).
Charlson Comorbidity Index (CCI)	The Charlson Comorbidity Index predicts the one-year mortality for a patient who may have a range of comorbid conditions, such as heart disease, AIDS, or cancer (a total of 22 conditions). Each condition is assigned a score of 1, 2, 3, or 6, depending on the risk of dying associated with each one.
Data Completeness	Also known as case ascertainment; meaning the number of cases eligible for inclusion in the audit with data captured.
Data Accreditation	The quantity of data entered per individual case.
Direct admissions	Describes care in the first treating hospital.
ED	Emergency Department
GCS	Glasgow Coma Scale (a measure of the level of consciousness)
HIPE	Hospital In-Patient Enquiry
Individual TARN submissions/ patients	Individual TARN submissions are those where there is no transfer between hospitals and where transfers have been matched by TARN.
IPMS	In-Patient Management System
IQR (interquartile range)	Range of values within a selection of data excluding the top 25% and bottom 25%. This filters out unusually high and unusually low values and shows where the most significant values in the data range are concentrated.
ISS	Injury Severity Score. A score ranging from 1, indicating minor injuries to 75, indicating very severe injuries that are very 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).
'Low falls'	Falls of 2 metres and less
Major Trauma Centre	A Major Trauma Centre (MTC) is a multi-specialty hospital, on a singlesite, optimised for the provision of trauma care. It is the focus of the trauma network and manages all types of injuries, providing consultant-level care NHS Clinical Advisory Groups Report (UK) (2010).
Mean	This value is determined by adding all the data points in a population and then dividing the total by the number of points. The resulting number is known as the mean or the average.
Median	The middle value in a range. Less easily distorted by very high or very low values than other aggregation methods, such as the mean.
МТА	Major Trauma Audit
Multidisciplinary	A group of people of different professions including medical personnel from potentially multiple specialties i.e. emergency medicine, orthopaedics, cardiothoracics etc, nursing, physiotherapist, occupational therapists, other allied healthcare professionals with job plan responsibilities for the assessment and treatment of major trauma patients, and who convene (including face to face or virtually) collaboratively to discuss patient treatment and care and plan shared clinical care goals.

NCCC	National Clinical Effectiveness Committee		
NCEC	National Clinical Effectiveness Committee		
NICE	National Institute for Health and Care Excellence. This organisation sets standards for patient care including for severe head injury, trauma service delivery.		
PCR	Patient Care Record		
PHECC	The Pre-Hospital Emergency Care Council (PHECC) maintains a statutory register of all pre-hospital emergency care practitioners, such as paramedics and advanced paramedics, who meet their standards.		
PROMS	Patient Reported Outcome Measures		
TARN	Trauma Audit and Research Network		
ТВІ	Traumatic brain injury		
Trauma unit	A trauma unit (TU) is a hospital in a trauma network that provides care for most injured patients (NHS Clinical Advisory Groups Report (UK)(2010).		
Ws	A measure of excess deaths or survivors (W) standardised according to hospital case mix using the TARN fraction. A hospital with the same case mix as the overall TARN population will have identical W and Ws values. A hospital whose case mix differs from the overall TARN population will have different W and Ws values.		

APPENDIX 3: MTA GOVERNANCE COMMITTEE

NOCA wish to acknowledge the contribution and support of the members of the MTA Governance Committee.

ROLE	NAME
National Board for Ireland of the College of Emergency Medicine	
(Clinical Lead and Chair of MTA Governance Committee)	Dr Conor Deasy
Royal College of Surgeons in Ireland - Neurosurgery Programme	Mr David Alcutt ¹
NOCA IHFD and MTA Coordinator	Ms Louise Brent
Irish Association for Emergency Medicine	Dr Tomás Breslin
Emergency Medicine Nursing Interest Group	Ms Ann Calvert
Royal College of Surgeons in Ireland - Neurosurgery Programme	Mr Darach Crimmins
NOCA Head of Quality & Development	Ms Marina Cronin
National Ambulance Service	Mr Vincent Daly
HSE National Clinical Programme for Older People	Dr Rachael Doyle
Data manager with Trauma Audit experience	Ms Anna Duffy
Senior Accountable Health Manager	Mr Gordon Dunne
Pre-Hospital Emergency Care Council	Ms Jacqueline Egan
Public Representative - Patient Focus	Ms Orlaith Ferguson
Royal College of Physicians Ireland - Pathology	Dr Joan Fitzgerald
National Emergency Medicine Programme Lead	Dr Una Geary
Royal College of Physicians Ireland - Pathology	Dr Patrick Hayden¹
Irish Association for Emergency Medicine	Dr Patricia Houlihan ¹
Hospital HIPE Manager	Ms Nora Hourigan
Royal College of Surgeons in Ireland - General Surgery	Mr Dara Kavanagh
Irish Committee for Emergency Medicine Training Chair / Nominee	Dr Gerry Lane
National Emergency Medicine Programme Nominee for MTA	Dr George Little
Royal College of Surgeons in Ireland - Faculty of Radiologists	Dr Peter MacMahon
Paediatric Emergency Medicine	Dr Ciara Martin
Royal College of Physicians Ireland - Public Health	Dr Caroline Mason Mohan
Emergency Medicine Nursing Interest Group	Ms Fiona McDaid ¹
Royal College of Physicians Ireland - Rehabilitation Medicine	Dr Jacinta McElligott
Royal College of Surgeons in Ireland - Irish Association of Vascular Surgeons	Mr Morgan McMonagle
Royal College of Surgeons in Ireland - General Surgery	Mr Ken Mealy ¹
Joint Faculty of Intensive Care Medicine of Ireland Nominee - Critical Care	Dr Jeanne Moriarty
Irish Institute of Trauma and Orthopaedic Surgeons - Trauma and Orthopaedic Programme	Mr Brendan O'Daly
Data manager with HIPE experience	Mr Des O'Toole
Therapy Representative	Ms Rosie Quinn
HSE Office of Nursing and Midwifery Services	Ms Geraldine Shaw
NOCA Executive Director	Ms Collette Tully
Patient / Public Representative	Awaiting Nomination
Irish Association of Plastic Surgeons	Awaiting Nomination

 $^{^{\}mbox{\tiny 1}}\mbox{Resigned}$ from the MTA Governance Committee during 2016/2017.

APPENDIX 4: FREQUENCY TABLES

FIGURE 1: COMPLETENES PER HOSPITAL	S PERCENTAGES	
Hospital	N	%
A	151	100%
В	255	100%
С	138	100%
D	414	97%
E	92	97%
F	68	87%
G	107	87%
Н	146	84%
1	429	83%
J	309	79%
K	423	76%
L	338	74%
M	359	73%
N	34	72%
0	295	71%
Р	334	71%
Q	25	69%
R	453	65%
S	50	64%
T	103	61%
U	121	58%
V	52	55%
W	114	54%
Χ	188	48%
Υ	26	38%
Z	64	36%

PERCENTAGES PER HOSP	ITAL	
Hospital	N	%
D	414	99%
A	151	99%
С	138	99%
Н	146	98%
В	255	98%
R	453	98%
K	423	98%
T	103	98%
W	114	98%
0	295	98%
N	34	97%
Е	92	97%
Χ	188	97%
S	50	96%
Z	64	96%
L	338	96%
Υ	26	96%
V	52	95%
1	429	95%
Р	334	95%
М	359	94%
J	309	94%
G	107	93%
F	68	92%
Q	25	92%
U	121	87%
Ireland	5,088	96%

FIGURE 2: DATA ACCREDITATION

FIGURE 3: DATA ACCREDITATION BY KEY DATAFIELDS

Ireland

5,088

74%

Key Data fields	Ν	%
Pre-existing conditions	5,088	100
Arrival time	5,088	100
Operation details	2,158	99
CT details	3,444	99
Doctors in the ED	4,645	97
Glasgow Coma Scale (GCS)	5,070	97
Injury detail	5,088	96
Transfer details	1,987	96
Pupil reactivity	1,264	93
Incident/ 999 call details	5,088	89
National mean accreditation		97

FIGURE 4: GENDER BREAKDOWN OF MAJOR TRAUMA PATIENTS

Gender	N	%
Female	1,843	41.64
Male	2,583	58.36
Total	4,426	100.0

FIGURE 5: GENDER BREAKDOWN OF MAJOR TRAUMA PATIENTS BY AGE BAND

Age	Female	Male	Total
<15	36.99	63.01	100.00
15-24	22.78	77.22	100.00
25-34	22.47	77.53	100.00
35-44	17.49	82.51	100.00
45-54	30.23	69.77	100.00
55-64	45.49	54.51	100.00
65-74	47.06	52.94	100.00
75-84	59.89	40.11	100.00
85+	71.65	28.35	100.00
Total	41.64	58.36	100.00

FIGURE 6: CHARLSON COMORBIDITY INDEX SCORES OF MAJOR TRAUMA PATIENTS

Charlson score	N	%
1 - 5	1,623	36.67
6 - 10	429	9.69
>10	102	2.30
No significant PMC	2,246	50.75
Not recorded	26	0.59
Total	4,426	100.00

FIGURE 6A: COMORBIDITIES OF MAJOR TRAUMA PATIENTS BY AGE BAND

Age	1-5	6-10	>10	No significant PMC	Total
<15	6.57	0.00	0.00	93.43	100.00
15-24	13.67	0.25	0.00	86.08	100.00
25-34	20.00	0.67	0.22	79.11	100.00
35-44	29.10	2.49	1.49	66.92	100.00
45-54	38.99	3.98	2.31	54.72	100.00
55-64	40.60	9.04	3.59	46.77	100.00
65-74	48.37	14.54	1.96	35.13	100.00
75-84	49.64	21.54	3.99	24.82	100.00
85+	51.88	20.53	4.19	23.40	100.00
Total	36.89	9.75	2.32	51.05	100.00

FIGURE 7: MECHANISM OF INJURY

Mechanism of injury	Ν	%
Blows	451	10.19
Burns/blasts	93	2.10
Crush	41	0.93
Fall less than 2m	2,272	51.33
Fall more than 2m	594	13.42
Road trauma	807	18.23
Shooting	14	0.32
Stabbing	58	1.31
Other	96	2.17
Total	4,426	100.00

FIGURE 7A: MECHANISM OF INJURY BY AGE BAND

Age	Blows	Fall <2m	Fall >2m	Other	Road trauma	Total
<15	10.05	36.99	12.79	17.35	22.83	100.00
15-24	30.63	12.91	8.35	11.14	36.96	100.00
25-34	27.31	11.67	11.67	14.32	35.02	100.00
35-44	22.17	21.92	20.44	9.85	25.62	100.00
45-54	8.28	40.37	20.70	7.25	23.40	100.00
55-64	3.86	63.95	16.60	3.72	11.87	100.00
65-74	2.78	61.27	18.46	3.92	13.56	100.00
75-84	0.85	81.51	7.40	2.70	7.54	100.00
85+	0.88	89.67	3.52	2.42	3.52	100.00
Total	10.19	51.33	13.42	6.82	18.23	100.00

FIGURE 9: INJURY SEVERITY SCORE (ISS)

ISS Category	N	%
Low-severity injury	1,192	26.93
Moderate-severity injury	1,860	42.02
Severe injury	1,374	31.04
Total	4,426	100.00

FIGURE 9A: INJURY SEVERITY SCORE (ISS) BY AGE BAND

ISS CATEGORY

Age	Low	Moderate	Severe	Total
<15	22.83	43.38	33.79	100.00
15-24	37.22	29.37	33.42	100.00
25-34	28.85	31.28	39.87	100.00
35-44	29.06	34.73	36.21	100.00
45-54	21.53	47.00	31.47	100.00
55-64	17.88	57.08	25.04	100.00
65-74	24.18	41.99	33.82	100.00
75-84	29.02	42.25	28.73	100.00
85+	36.26	40.88	22.86	100.00
Total	26.93	42.02	31.04	100.00

FIGURE 10: PLACE OF INJURY

Place of injury	N	%
Farm	157	3.55
Home	2,077	46.93
Industrial	84	1.90
Institution	172	3.89
Public area and road	1,714	38.73
Other	222	5.02
Total	4,426	100.00

FIGURE 10A: PLACE OF INJURY BY AGE BAND

PLACE OF INJURY

Age	Farm	Ноте	Institution	Other	Public area	Total
					/road	
<15	1.37	50.68	1.37	2.28	44.29	100.00
15-24	4.05	13.92	0.76	6.58	74.68	100.00
25-34	2.64	15.42	1.10	12.56	68.28	100.00
35-44	5.42	26.60	2.22	12.81	52.96	100.00
45-54	5.59	37.27	1.45	9.52	46.17	100.00
55-64	4.58	52.07	2.58	8.30	32.47	100.00
65-74	4.90	59.80	2.61	5.72	26.96	100.00
75-84	1.56	72.26	6.12	2.42	17.64	100.00
85+	0.88	69.23	14.95	2.20	12.75	100.00
Total	3.55	46.93	3.89	6.91	38.73	100.00

FIGURE 10B: PLACE OF INJURY BY ISS GROUP

ISS CATEGORY

				1
Place of injury	Low	Moderate	Severe	Total
Farm	22.93	45.86	31.21	100.00
Home	26.34	47.33	26.34	100.00
Industrial	23.81	38.10	38.10	100.00
Institution	22.09	43.02	34.88	100.00
Public area and road	28.65	35.88	35.47	100.00
Total	26.93	42.25	30.83	100.00

FIGURE 11: TYPE OF ROAD TRAUMA

Vehicle position	N	%
Car	407	50.43
Cyclist	160	19.83
Motorcycle	105	13.01
Pedestrian	125	15.49
Not known	10	1.24
Total	807	100.00

FIGURE 11A: POSITION IN VEHICLE OF THOSE INVOLVED IN CAR ACCIDENTS

Vehicle position	Ν	%
Driver	271	66.58
Front-seat passenger	70	17.20
Back-seat passenger	48	11.79
Position not known	18	4.42
Total	407	100.00

FIGURE 11B: TYPE OF ROAD TRAUMA BY ISS GROUP

ISS CATEGORY

				1
Vehicle position	Low	Moderate	Severe	Total
Car	23.83	32.92	43.24	100.00
Cyclist	26.88	44.38	28.75	100.00
Motorcycle	16.19	47.62	36.19	100.00
Pedestrian	21.60	22.40	56.00	100.00
Total	23.09	35.51	41.41	100.00

FIGURE 12: INJURIES AT HOME BY GENDER

Gender	N	%
Female	1,131	54.45
Male	946	45.55
Total	2,077	100.00

FIGURE 12A: INJURIES AT HOME BY GENDER AND AGE BAND

Age	Male	Female	Total
<15	63.96	36.04	100.00
15-24	76.36	23.64	100.00
25-34	74.29	25.71	100.00
35-44	75.93	24.07	100.00
45-54	61.11	38.89	100.00
55-64	43.13	56.87	100.00
65-74	47.81	52.19	100.00
75-84	34.84	65.16	100.00
85+	25.40	74.60	100.00
Total	45.55	54.45	100.00

FIGURE 12B: INJURIES AT HOME BY MECHANISM OF INJURY

Mechanism	N	%
Blow(s)	52	2.50
Burn	77	3.71
Fall less than 2m	1,501	72.27
Fall more than 2m	360	17.33
Other	65	3.13
Stabbing	22	1.06
Total	2,077	100.00

FIGURE 13: INJURIES AT HOME BY CHARLSON COMORBIDITY INDEX SCORE

Charlson Comorbidity Index Score	N	%
1 - 5	937	45.11
6 - 10	278	13.38
>10	65	3.13
No significant PMC	788	37.94
Not known	9	0.43
Total	2,077	100.00

FIGURE 13A: INJURIES AT HOME BY CHARLSON COMORBIDITY INDEX SCORE AND AGE BAND

Age	No significant PMC	1-5	6-10	>10	Total
<15	91.59	8.41	0.00	0.00	100.00
15-24	72.73	27.27	0.00	0.00	100.00
25-34	65.22	31.88	1.45	1.45	100.00
35-44	59.26	36.11	4.63	0.00	100.00
45-54	41.90	47.49	5.59	5.03	100.00
55-64	41.76	44.51	8.79	4.95	100.00
65-74	30.60	51.37	15.85	2.19	100.00
75-84	25.69	50.00	21.74	2.57	100.00
85+	22.93	52.23	19.75	5.10	100.00
Total	38.10	45.31	13.44	3.14	100.00

FIGURE 14: INJURIES SUSTAINED AT HOME BY ISS

ISS category	N	%
Low-severity injury	547	26.34
Moderate-severity injury	983	47.33
Severe injury	547	26.34
Total	2,077	100.00

FIGURE 14A: INJURIES SUSTAINED AT HOME BY ISS AND AGE BAND

Age	Low	Moderate	Severe	Total
<15	27.03	47.75	25.23	100.00
15-24	27.27	23.64	49.09	100.00
25-34	21.43	35.71	42.86	100.00
35-44	29.63	35.19	35.19	100.00
45-54	18.89	53.33	27.78	100.00
55-64	16.48	64.56	18.96	100.00
65-74	24.04	43.17	32.79	100.00
75-84	29.33	46.26	24.41	100.00
85+	39.37	41.27	19.37	100.00
Total	26.34	47.33	26.34	100.00

FIGURE 15: INJURIES AT HOME BY MORTALITY

Outcome	n	%
Alive	1,973	95.04
Dead	104	4.96
Total	2,077	100.00

FIGURE 16: HEAD INJURY SEVERITY (AIS 3+)

GCS category	N	%
GCS 13-15	748	74.80
GCS 9-12	97	9.7
GCS 3-8	155	15.50
Total	1.000	100.00

FIGURE 16A: HEAD INJURY SEVERITY BY AGE BAND AND GCS

GCS CATEGORY

			1	
Age	13-15	9-12	<9	Total
<15	64.06	14.06	21.88	100.00
15-24	69.14	7.41	23.46	100.00
25-34	61.16	14.88	23.97	100.00
35-44	67.02	14.89	18.09	100.00
45-54	69.79	10.42	19.79	100.00
55-64	80.83	10.83	8.33	100.00
65-74	78.26	6.83	14.91	100.00
75-84	83.53	7.65	8.82	100.00
85+	88.17	3.23	8.60	100.00
Total	74.80	9.70	15.50	100.00

FIGURE 16B: CAUSE OF INJURY IN PATIENTS WITH SEVERE TBI

Mechanism of injury	N	%
Alleged assault	18	11.61
Fall less than 2m	40	25.81
Fall more than 2m	39	25.16
Road trauma	58	37.42
Total	155	100.00

FIGURE 16C: CAUSE OF INJURY IN PATIENTS WITH SEVERE TBI BY AGE BAND

MECH.	ANISM	OF IN	JURY

Age	Alleged assault	Fall <2m	Fall >2m	Road trauma	Total
<15	0.00	0.00	35.71	64.29	100.00
15-24	15.79	5.26	5.26	73.68	100.00
25-34	31.03	10.34	10.34	48.28	100.00
35-44	17.65	11.76	29.41	41.18	100.00
45-54	5.26	26.32	36.84	31.58	100.00
55-64	0.00	50.00	40.00	10.00	100.00
65-74	4.17	29.17	45.83	20.83	100.00
75-84	0.00	80.00	20.00	0.00	100.00
85+	12.50	62.50	0.00	25.00	100.00
Total	11.61	25.81	25.16	37.42	100.00

FIGURE 17: MODE OF ARRIVAL TO HOSPITAL

Mode of arrival	N	%
Ambulance	2,263	70.85
Ambulance and helicopter	29	0.91
Car	400	12.52
Helicopter	25	0.78
Not applicable	24	0.75
Other	18	0.56
Walking	69	2.16
Not known	366	11.46
Total	3,194	100.00

FIGURE 18: MOST SENIOR PRE-HOSPITAL HEALTHCARE PROFESSIONAL

Most senior pre-hospital healthcare professional N		%
Advanced paramedic	760	32.80
Doctor	17	0.73
Other	5	0.22
Paramedic	1,278	55.16
Not known	257	11.09
Total	2,317	100.00

FIGURE 19: PATIENTS TRANSFERRED TO ANOTHER HOSPITAL

Transfer type	N	%
No transfer	3,194	72.16
Transfer	1,232	27.83
Total	4,426	100.00

FIGURE 20: CARE PATHWAY OF PATIENTS WITH TBI

Transfer type	N	%
Direct admission to neurosurgical centre	111	11
Transfer to neurosurgical centre	245	25
Not transferred to neurosurgical centre	644	64
Total	1,000	100.00

FIGURE 20A: SEVERE TBI AND ADMISSIONS TO A NEUROSURGICAL UNIT

Transfer type	N	%
Direct admission to neurosurgical centre	17	11
Transfer to neurosurgical centre	68	44
Not transferred to neurosurgical centre	70	45
Total	155	100.00

FIGURE 21: PRESENTATION BY TIME OF DAY

Time of day	Ν	%	Cumulative
00	112	2.54	2.54
01	126	2.86	5.40
02	102	2.31	7.71
03	94	2.13	9.84
04	106	2.40	12.25
05	75	1.70	13.95
06	72	1.63	15.58
07	68	1.54	17.12
08	107	2.43	19.55
09	171	3.88	23.43
10	210	4.76	28.19
11	264	5.99	34.18
12	281	6.37	40.55
13	279	6.33	46.88
14	260	5.90	52.78
15	292	6.62	59.40
16	251	5.69	65.09
17	240	5.44	70.54
18	264	5.99	76.53
19	266	6.03	82.56
20	218	4.94	87.50
21	208	4.72	92.22
22	180	4.08	96.30
23	163	3.70	100.00
Total	4,409	100.00	

FIGURE 22: PRE-ALERT BY AGE BAND

Age	N	%
<15	10	4.83
15-24	27	13.04
25-34	37	17.87
35-44	25	12.08
45-54	32	15.46
55-64	25	12.08
65-74	26	12.56
75-84	16	7.73
85+	9	4.35
Total	207	100.00

FIGURE 23: RECEPTION BY A TRAUMA TEAM BY AGE BAND

Age	N	%
<15	16	5.90
15-24	31	11.44
25-34	40	14.76
35-44	31	11.44
45-54	37	13.65
55-64	31	11.44
65-74	28	10.33
75-84	39	14.39
85+	18	6.64
Total	271	100.00

FIGURE 24: GRADE OF MOST SENIOR DOCTOR TREATING PATIENT ON ARRIVAL BY AGE BAND

MOST SENIOR DOCTOR

						1
Age	Consultant	Spec. Reg	Registrar	SHO	Other/No grade	Total
<15	33.94	19.27	34.86	9.17	2.75	100.00
15-24	22.51	20.35	43.72	8.23	5.19	100.00
25-34	26.33	17.79	42.70	7.47	5.69	100.00
35-44	25.39	17.19	46.09	7.81	3.52	100.00
45-54	23.70	16.18	41.62	13.29	5.20	100.00
55-64	18.95	16.32	44.84	17.64	2.25	100.00
65-74	22.61	15.00	44.35	15.87	2.17	100.00
75-84	20.51	13.50	48.21	15.04	2.74	100.00
85+	18.07	9.67	52.16	15.78	4.33	100.00
Total	22.10	15.37	45.43	13.56	3.54	100.00

FIGURE 25: SURGICAL INTERVENTION BY BODY REGION

Operation type	N	%
Abdomen	59	4.84
Face	110	9.02
General	22	1.80
Head and brain	19	1.56
Limbs	847	69.48
Skin/soft tissue	90	7.38
Spine	52	4.27
Thoracic	20	1.64
Total	1,219	100.00

FIGURE 26: MEDIAN TIME (IN HOURS) TO SURGERY FOR PATIENTS HAVING SURGICAL INTERVENTION BY BODY AREA

Operation type	Median
Abdomen	6.6
Face	72.2
General	19.0
Head and brain	18.8
Limbs	25.4
Skin/soft tissue	26.0
Spine	90.5
Thoracic	65.2
Total	28.1

FIGURE 27: PERCENTAGE OF SURGERY WITHIN 24, 48 AND 72 HOURS

Cumulative Time	N	%
24 hours	520	44
48 hours	795	67
72 hours	936	78

FIGURE 28: AIRWAY MANAGEMENT OF PATIENTS WITH GCS <9

Airway management	N	%
No intubation	3	2
Intubated- ED	89	68
Intubated- pre-hospital	1	1
Intubated both at ED	13	10
and pre-hospital		
Not known	24	18
Total	130	100

FIGURE 29: SURVIVAL OF SHOCKED PATIENTS

Outcome	N	%
Alive	271	95.09
Dead	14	4.91
Total	285	100.00

FIGURE 30: TIME TO CT SCAN WITHIN ONE HOUR

	Ν	%
Yes	82	32.67
No	169	67.33
Total	251	100.00

FIGURE 31: HOSPITAL LENGTH OF STAY FOR MAJOR TRAUMA PATIENTS BY AGE BAND

Age	Median LOS
<15	5
15-24	6
25-34	6
35-44	8
45-54	7
55-64	8
65-74	10
75-84	13
85+	13
Total	9

FIGURE 32: MORTALITY BY AGE BAND

Age	N	%
<15	4	2.07
15-24	13	6.74
25-34	15	7.77
35-44	5	2.59
45-54	14	7.25
55-64	17	8.81
65-74	31	16.06
75-84	47	24.35
85+	47	24.35
Total	193	100.00

FIGURE 33: MORTALITY BY GENDER AND AGE BAND

Female	Male	Total
25.00	75.00	100.00
33.33	66.67	100.00
50.40	49.60	100.00
43.01	56.99	100.00
	25.00 33.33 50.40	25.00 75.00 33.33 66.67 50.40 49.60

FIGURE 34: MORTALITY BY MECHANISM OF INJURY

Cause of Injury	N	%
Fall less than 2m	106	55
Fall more than 2m	21	11
Road trauma	30	16
Other	36	19
Total	193	100

FIGURE 34A: MORTALITY BY MECHANISM OF INJURY BY AGE BAND

Age	Fall <2m	Fall >2m	Other	Road trauma	Total
<34	0.00	3.13	56.25	40.63	100.00
35-64	30.56	25.00	30.56	13.89	100.00
65+	76.00	8.80	5.60	9.60	100.00
Total	54.92	10.88	18.65	15.54	100.00

FIGURE 35: MORTALITY BY ISS BAND

ISS	N	%
Low	11	6
Moderate	31	16
Severe	151	78
Total	193	100

FIGURE 36: MAJOR TRAUMA DEATHS BY BODY AREA INJURED BY AGE BAND

Age	Chest	Head	Limbs	Multiple	Other	Spine	Total
<34	6.25	28.13	3.13	12.50	50.00	0.00	100.00
35-64	8.33	44.44	11.11	13.89	22.22	0.00	100.00
65+	5.60	65.60	13.60	4.00	4.80	6.40	100.00
Total	6.22	55.44	11.40	7.25	15.54	4.15	100.00

FIGURE 37: GLASGOW OUTCOME SCALE BY AGE BAND

GOS CATEGORY

Age	Good Recovery	Moderate Disability	Severe Disability	Death	Other/ Not recorded	Total
<15	84.47	4.11	2.74	1.83	6.85	100.00
15-24	74.18	10.38	6.08	3.29	6.08	100.00
25-34	71.59	11.23	7.71	3.08	6.39	100.00
35-44	66.50	15.76	10.84	1.23	5.67	100.00
45-54	68.94	15.11	7.25	3.31	5.38	100.00
55-64	62.52	23.46	6.87	2.58	4.58	100.00
65-74	54.74	24.84	8.01	5.23	7.19	100.00
75-84	48.93	30.16	5.41	7.97	7.54	100.00
85+	43.30	33.63	6.15	11.65	5.27	100.00
Total	61.43	20.76	6.94	4.77	6.10	100.00

FIGURE 37A: GLASGOW OUTCOME SCALE IN PATIENTS WITH HEAD INJURY BY AGE BAND

GOS CATEGORY

Age	Good Recovery	Moderate Disability	Severe Disability	Death	Other/ Not recorded	Total
<15	82.28	3.80	2.53	3.80	7.59	100.00
15-24	69.07	7.22	13.40	2.06	8.25	100.00
25-34	60.77	7.69	16.15	5.38	10.00	100.00
35-44	50.89	20.54	17.86	0.89	9.82	100.00
45-54	60.75	11.21	13.08	5.61	9.35	100.00
55-64	54.55	16.08	11.89	9.09	8.39	100.00
65-74	54.30	14.52	9.14	13.44	8.60	100.00
75-84	42.86	18.88	8.16	20.41	9.69	100.00
85+	37.84	24.32	9.01	25.23	3.60	100.00
Total	54.95	14.56	11.20	10.77	8.53	100.00

FIGURE 37B: GLASGOW OUTCOME SCALE IN PATIENTS WITH ISS>15 BY AGE BAND

GOS CATEGORY

Age	Good Recovery	Moderate Disability	Severe Disability	Death	Other/ Not recorded	Total
<15	81.08	5.41	2.70	5.41	5.41	100.00
15-24	56.06	9.85	15.91	9.09	9.09	100.00
25-34	59.12	8.84	16.02	7.73	8.29	100.00
35-44	49.66	13.61	23.81	3.40	9.52	100.00
45-54	57.24	10.53	14.47	10.53	7.24	100.00
55-64	57.71	11.43	14.86	8.00	8.00	100.00
65-74	50.24	17.39	12.56	12.08	7.73	100.00
75-84	45.54	18.32	8.42	20.30	7.43	100.00
85+	32.69	25.96	8.65	28.85	3.85	100.00
Total	53.28	13.76	13.61	11.72	7.64	100.00

FIGURE 38: DISCHARGE DESTINATION

Discharge destination	N	%
Home	2,732	61.73
Other acute hospital	554	12.52
Nursing Home	475	10.73
Rehabilitation	353	7.98
Mortuary	193	4.36
Other institution	87	1.97
Total	4,426	100.00

Age	Ноте	Other Acute Hospital	Nursing Home	Rehabilitation	Mortuary	Other Institution	Total
<15	84.86	11.93	0.00	0.46	1.83	0.92	100.00
15-24	80.36	14.54	0.00	1.02	3.32	0.77	100.00
25-34	77.97	15.20	0.00	2.20	3.08	1.54	100.00
35-44	73.76	18.56	1.49	3.22	1.24	1.73	100.00
45-54	74.69	13.18	1.46	5.65	2.93	2.09	100.00
55-64	65.76	11.37	7.48	10.94	2.45	2.01	100.00
65-74	56.23	14.10	12.95	9.51	5.08	2.13	100.00
75-84	42.11	9.99	23.01	16.06	6.66	2.17	100.00
85+	29.33	6.67	38.22	11.78	10.44	3.56	100.00
Total	62.18	12.61	10.81	8.03	4.39	1.98	100.00

APPENDIX 5: MEDIAN TIME TO SURGERY BY BODY REGION AND AGE BAND

		<15			15-24			25-34			35-44			45-54	
Body region	Median	IOR	z	Median	IQR	z	Median	IOR	z	Median	IQR	z	Median	IQR	z
Abdomen	100.9	5.6-196.1	2	5.3	2.8-8.6	13	9.9	4.6-15	19	3.6	2.8-5.1	72	5.8	3.9-47.2	4
Face	58.5	43.8-73.2	2	63	45.8-87.8	34	68.8	43.6-111	27	72.3	54.5-149.1	27	103.8	50.7-144.4	10
General	15.9	15.9-15.9	1	7.4	0.7-14.1	2	6.4	6.4-6.4	1	8.3	3.3-128.5	3	17.9	9.7-34	4
Head and brain	2.1	1.6-2.6	2	63.1	12-191	4	39.7	2.8-574.9	3	3.5	1.5-5.5	2	3.3	3.3-3.3	-
Limbs	35.8	14.9-70.2	40	29.8	16.1-47.7	35	26.3	18.8-46.6	55	20.1	14.3-44	29	21.9	16.5-33.8	113
Skin/soft tissue	54.3	4.7-85.8	10	18.9	12-41.7	15	24.9	17.9-45.7	7	20.6	14-40.9	14	51.5	24.3-74.3	6
Spine	0	0	0	57.1	26.6-65.2	2	144.7	61.4-228	2	67.4	20.2-96.5	9	82.8	67.2-139.6	9
Thoracic	0	0	0	0	0	0	49.6	4.25-104.6	4	298	62.2-486.4	4	177.7	27.7-191.4	3
		55-64			65-74			74-84			>85			All patients	
Body region	Median	IOR	z	Median	IQR	z	Median	IOR	z	Median	IQR	Z	Median	IQR	z
Abdomen	15.4	3.6-47	9	8.1	2.5-13.1	4	140.9	23.4-258.3	2	252.5	197.1-307.9	2	9.9	3.6-24.8	57
Face	97.6	70.3-186.7	2	50.4	50.4-50.4	-	0	0	0	0	0	0	72.2	50.4-111.2	106
General	19.1	18.8-22.6	2	364.3	364.3-364.3	-	110.2	24.7-263.9	4	409.4	409.4-409.4	-	19	6.4-95.9	22
Head and brain	35.3	10.4-436.8	4	145.3	145.3-145.3	-	0	0	0	233.8	233.8-233.8	-	18.8	3.3-145.3	18
Limbs	25.3	19-46.5	234	28.6	19.5-53.9	92	28.9	20.8-61.7	115	27.1	18.8-48.5	84	25.4	17.8-48.4	835
Skin/soft tissue	24.5	18.4-46.3	14	61.5	14.2-95.4	80	182.3	66.7-203.2	2	23	15.2-156.8	4	56	15.5-71.5	98
Spine	68.1	27.2-78.4	6	111	60.7-131.8	6	177.5	75.7-297.2	12	153.9	124-428.6	3	91	52.4-143.9	52
Thoracic	4.7	4.7-4.7	-	98.6	13-459.1	3	23.8	20-45.4	4	0	0	0	65.2	13-177.7	19

TABLE 10: MEDIAN TIME TO SURGERY (IN HOURS) BY BODY REGION AND AGE BAND









