Northern Lights Regional Health Center
Regional Trauma Program
Annual Report

2016-2018

Alberta Health Services

Emergency
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Forward

While annual trauma reports are often a valuable source to identify areas of improvement, they can also represent a tool to highlight the progress that has been made in programs, focusing on the benefits that have been identified on a year-to-year comparison.

As the most northern region in Alberta our demographics focus on a young high-risk population in a heavily industrialized area. Year to year has shown a significant decline in workplace and recreational accidents through a collaborative community effort encompassing industry, health and education.

The provincial program gives us the tools to make accurate comparative data with inter-regional discussions utilizing the resources throughout the province.

This year will mark another historic step in improving our EMS system with the completion of the hospital heli-port to accommodate our HERO rotary retrieval unit making a dramatic difference in our time to patient.

We are hopeful this report will help stimulate even more discussions on how to continue in our trauma improvement efforts in the Ft. McMurray region

Dr. Brian Dufresne CCFP-EM
Trauma Medical Director
Introduction
Northern Lights Regional Health Center Trauma Program

Trauma is one of the leading health problems faced in the world (WHO, 2004). Approximately 16,000 Canadians will die each year from preventable trauma. Injury is the leading cause of death for Canadians ages 1-44 (Parachute Canada). Not only is there a human toll but the financial costs of injury are paramount, exceeding the cost of heart disease and stroke. Preventable injuries account for 3.5 million Emergency Room visits per year.

Diligence to best practice for management of traumatic injury is essential for decreased associated mortality and morbidity. A comprehensive, concise and collaborative trauma system is imperative to achieving optimal, accessible care. The Trauma Association of Canada (TAC) has defined five levels for trauma services. Levels I and II, are the highest level of care, located in urban centers. Level I are university affiliated, this often includes but is not a defining criteria for Level II centers. Level III centers are required in areas without access to I and II facilities. They are large or medium sized, community-based medical centers that are generally not university affiliated. Levels IV, V provide trauma care to small rural areas or within urban areas.

The Northern Lights Regional Health Centre (NLRHC) is a Level III trauma center, located in the city of Fort McMurray. The NLRHC provides trauma care to the catchment population of the Regional Municipality of Wood Buffalo (RMWB) and surrounding areas. As of the 2016 census the population in the RMWB was 71,589 (Statistics Canada), and the population of the city of Fort McMurray 66,573 (Statistics Canada). Northern Alberta is rich in key resources, which support economic growth in the region including forestry, and energy. As national and international demands for natural
resources increase, the need for workers to support this expanding process follows. These workers account for a transient population who work in, but reside outside of the local area. This populous is "collectively referred to as the shadow population" (Northern Alberta Development Council). In 2017, the Government of Alberta, Municipal Affairs recorded a census of 114,673 inclusive of shadow population. This population increases the demands on regional health and trauma systems. The NLRHC strives to deliver high quality trauma care to all injured patients.

1.0 Mission

To continuously evaluate and improve the delivery of quality trauma services in the region through:
- Inter-professional care
- Continuum of Care (pre and inter hospital, primary acute care, secondary referral, and tertiary care, including transport)
- Timely Care—Right Care, Right Patient, Right Time
- Best practice

2.0 Trauma Program Members/Committee Members:

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trauma Medical Director</td>
<td>Dr. Brian Dufresne</td>
</tr>
<tr>
<td>Trauma Coordinator</td>
<td>Heidi Wright, **Stephanie Howse</td>
</tr>
<tr>
<td>Trauma Data Analyst</td>
<td>Kim McOuat, **Roy Elamathial</td>
</tr>
<tr>
<td>Manager, Emergency/ICU</td>
<td>Jamie Atkin, **Michelle VanBeek, **Pam Lund, **Kerry McCann</td>
</tr>
<tr>
<td>Staff Surgeon</td>
<td>Dr. Lorne Zuk</td>
</tr>
</tbody>
</table>

** Reflect people who held these positions in 2016, 2017, and 2018
3.0 Trauma Program Member Roles

Trauma Medical Director
The Trauma Medical Director provides leadership and direction to the Regional Trauma Program. The Medical Director oversees trauma initiatives and program implementation, as well as participates in Performance Improvement and Patient Safety programs. The Medical Director leads a multidisciplinary team, which strives to provide the best possible care and outcome for trauma patients in our region.

Trauma Coordinator
The Trauma Coordinator is responsible for overseeing of the Trauma Program. The Coordinator participates in development and implementation of protocols and policies in the Trauma Program. Through the Performance Improvement and Patient Safety Program completes regular chart reviews, identifies trends and opportunities for improvement in patient care. Works collaboratively with staff to achieve quality improvement and clinical education, and development of educational programming. The Coordinator interprets data and trends in patient injury and trauma care. Works collaboratively with allied health with injury prevention initiatives.

Trauma Data Analyst
The data analyst is responsible for data abstraction, screening for eligible trauma cases, registry maintenance, registry data validation, quality improvement, and trauma program report generation, collecting and displaying data in chart and graph forms. The analyst works closely with the trauma coordinator, emergency department manager, and the medical director.
4.0 Goals of this Report

- To examine major traumas with an Injury Severity Score (ISS) ≥ 12 and penetrating injuries treated at the NLRHC
- To report information about trauma patients treated, admitted to or transferred from the NLRHC, or deceased while in the facility.
- To quantify data about major traumas admitted to the NLRHC
- Increase awareness of injury in our region, highlight areas of improvement through data analysis
- To support injury prevention programs within the region

5.0 Methodology

All information and statistics collected in this report are extracted from the Alberta Trauma Registry database.

As part of the American College of Surgeons Committee on Trauma (ACS CoT) and Accreditation Canada Guidelines, an accredited trauma center requires a trauma registry.

A trauma registry is a system, which provides the statistical groundwork for quality assurance activities. It is a comprehensive data management tool and report-writing package.

Data collected includes patient demographics, mechanism of injury, information from: pre-hospital, sending hospital, trauma center emergency department and trauma center inpatient documents. Operative data, injury diagnosis, patient outcome and specific audit filters and performance indicators are also collected. Data collection is analyzed, reviewed, and optimally results in improved delivery and quality of trauma care.

There are a total of 426 unique data elements. Some elements have multiple entries. A patient qualifies for entry to the database if they meet the following criteria:
- An Injury Severity Score (ISS) ≥12 admitted as an inpatient to NLRHC, or transferred to a higher level of care, or died in the ED
All penetrating injury as the primary mechanism of injury, regardless of ISS, with the criteria being inpatient admission to NLRHC > 24 hours and treatment in the operating room, or died in the ED

Not all admitted trauma patients are included in the trauma registry. To qualify, a patient must have an Injury Severity Score (ISS) ≥ 12 or have a penetrating mechanism and be admitted to the trauma center for > 24 hours, or receive treatment in the main operating room, or die in the emergency department of the trauma center. All NLRHC patients who have a trauma team activation are also included in the registry.

The Injury Severity Score (ISS) is an anatomical scoring tool that provides an overall score assessing trauma severity for patients with single system or multiple system injuries. Each injury is assigned an Abbreviated Injury Scale (AIS) score and is allocated to one of six body regions (head, including cervical spine; face; chest, including thoracic spine; abdomen, including lumbar spine; extremities, including pelvis; and external). The highest AIS score in each body region is used when calculating the ISS. In 2015, the current AIS 2005-Update 2008 manual was implemented. The three most severely injured body regions have their highest score squared and added together to produce the ISS score. A higher ISS score reflects a higher severity of injuries and increased incidence of mortality.

Excluded in these numbers are individuals who died at the scene because of traumatic injury, as coroner data is not collected. The Trauma Data Analyst compiles a list of trauma patients from Meditech who meet severe injury criteria. After careful scrutiny, the charts are filtered to include those with the above criteria. Patient related data is entered into the Alberta Trauma Registry. DI Report Writer is the program used to extract data for the purposes of this report.

6.0 Initiatives

Education

Between January 2016 and December 2018, the following education opportunities were provided on site:

- Advanced Cardiac Life Support (ACLS) – 24
- Advanced Cardiac Life Support; Experienced Provider (ACLS EP) -1
- Basic Life Support (BLS) – minimum five per month
- Pediatric Advanced Life Support (PALS) – 9
- Neonatal Resuscitation Program (NRP) – 25
- TNCC – 5

NLRHC participated in Trauma Grand Rounds, via telehealth, from the Foothills Medical Centre in Calgary. This allows physicians, nurses and allied health access to ongoing continuing education in Trauma.

Trauma Analyst completed the AIS08 course by Webinar: reviewing the Abbreviated Injury Scale and its uses, coding rules and conventions, assessing multiply injured patient.

Accreditation

AHS is currently involved with the Trauma Distinction accreditation process with Accreditation Canada.

“Trauma distinction recognizes trauma systems or networks that demonstrate clinical excellence and an outstanding commitment to leadership in trauma care”

https://accreditation.ca/trauma-distinction

Accreditation Canada asserts trauma distinction; enables risk mitigation and reduces high cost of errors, identifies opportunities for standardization of care, focuses on innovation and improved efficiency across the trauma network.

The Southern Alberta Trauma System (SATS) was accredited in October 2010 by the Trauma Association of Canada (TAC). It was one of the first trauma systems to be accredited in Canada.

NLRHC in collaboration with the Alberta Trauma Services (ATS) Core Leadership Team is working toward accreditation as a Level III Trauma Centre and provincial trauma distinction. This is scheduled for fall 2019 with
Accreditation Canada. Provincially we are working towards meeting standards and indicators as a Trauma System and a Trauma Center, identified by Accreditation Canada. The NLRHC Trauma Program has been actively participating in provincial learning collaborative meetings. Using these as a platform to share process and procedure and work towards a provincial standard of trauma distinction.

**Trauma Team Activation**

The primary goal of trauma team activation criteria is to ensure resources to address the clinical needs of injured patients are immediately available. The activation protocol is based on physiologic and anatomic injury criteria. Activating the trauma team to provide immediate resuscitation to the seriously injured trauma patient is vital in providing lifesaving diagnostic and clinical interventions and the efficient functioning of the trauma center. The trauma team activation criteria include Tier 1 criteria determined by the Trauma Association of Canada, further criteria are developed by individual sites.

The activation includes the immediate response of respiratory therapy, x-ray technologist, CT services, radiologist, laboratory and protective services to the Emergency Department. An additional call to the general surgeon, pediatrician, orthopedic surgeon and obstetrician are made at the discretion of the trauma team leader/ED physician. A member of the crisis team and the trauma coordinator respond as availability permits.

Trauma team activations are not limited to major trauma or ISS≥12. Minor trauma (ISS≤12) often meet criteria for TTA, these cases are reviewed by site but not included as central site cases in the Alberta Trauma Registry data.
7.0 Major Trauma Cases and Penetrating Trauma

Major trauma is defined by an Injury Severity Score (ISS) of ≥ 12. Minor trauma or ISS ≤11 may have TTA called if criteria is met. Qualifying penetrating trauma cases not classified as major trauma are included in this report as ISS ≤11. A significant increasing trend is noted for minor and or penetrating traumas (ISS≤11) with TTA activation in the region since 2016. The increase in the number of qualifying penetrating cases may be attributed to a change in the procedure for vetting charts.

Figure 1- Major Trauma Cases vs. Minor Trauma 2016-2018
7.0A Major Trauma by Year, 2011-2018

In October of 2015 per Transport Alberta, the highway connecting the city of Fort McMurray to the south, and the main thoroughfare for the region was 99% completed. This was a much-anticipated advancement for the region. From 2008 to 2012, there were 2,457 accidents recorded along the 443km route; 66 people were killed. In 2012, the provincial government supported completion of the twinning project of highway 63, projected to be completed in 2016. See related article [https://www.theglobeandmail.com/news/alberta/suicide-63-the-deadly-route-into-fort-mcmurray-finally-set-to-befixed/article28627352/].

Years 2014-2017; the region experienced a significant decrease in industrial development and investment, resulting in decreased expansion and employment within the oil and gas industry. Decreased value of oil and gas as a resource slowed economic growth and workforce in the region.

On the afternoon of May 3, 2016, approximately 88,000 people were evacuated from the city of Fort McMurray and surrounding communities when a wildfire threatened the region. Residents were prevented from returning to their homes for a 4 week period, after which repopulation was phased in. It is estimated that only 73,000 people have returned to the region. For further information, see related links:


[https://globalnews.ca/news/2734097/fort-mcmurray-wildfire-phased-re-entry-to-begin-wednesday-officials-asking-residents-to-respect-plan/].
The data below represents a significant decrease in major trauma from 2014 in the region. Through years 2016-2018 a decreased however stabilized instance of major trauma is noted. The Abbreviated Injury Scale 2005 (AIS, 2005) was implemented in Alberta in 2015. This new level of diagnostic detail altered the qualification for major injury; as a result, NLRHC experienced a reduced number of cases with high Injury Severity Score (ISS).

Figure 2-Major Trauma by Year, 2011-2018
7.0B Major Trauma by Type

Injury types are defined by the National Trauma Registry of Canada.

**Blunt injury:** Refers to the type of injury reflecting the cause of injury (i.e. motor vehicle collision, a blow to the head). Blunt injury may include deep lacerations caused by impact but does not include any injury in which a missile or cutting instrument enters the body.

**Penetrating injury:** Refers to any injury caused by a missile entering the body, human or animal bites, machinery that also include power or non-powered hand tools.

**Burns:** Refer to injuries to tissues caused by chemicals, radiation, electricity, heat or friction.

Below is a three year contrast of type of injury. Major trauma patients (ISS ≥ 12) presenting with blunt injury are consistently higher than penetrating injury or burns. This is consistent with 2015 where blunt trauma accounted for 75% of major trauma in the region.

![Figure 3- Major Trauma (ISS≥12) by Injury Type](image)
7.0C **Major Trauma by Injury Severity Score**

Injury Severity Score (ISS) is an internationally recognized scoring system developed to assign a level of severity to an injury. As an extension of the Abbreviated Injury Scale (AIS), it is the sum of the squares of the highest AIS score in each of the three most severely injured body regions. The ISS is 1 (minor) to 75 (major) with a higher score indicating increased severity and mortality.

Entry into the trauma registry requires, a classification as a major trauma or having an ISS score greater than or equal to 12.

Penetrating injuries with specific criteria are entered into the provincial trauma registry, but if they do not have an ISS ≥ 12, they are not reported as major trauma.

The following data represents a summation of all major trauma in the region by ISS score years 2016-2018

Of note, AIS 2005 was implemented in 2015 and the change accounts for a drop in qualifying trauma patients.

![Pie chart of Major Trauma by ISS 2016 - 2018](image)

*Figure 4* Major Trauma by ISS
The following graph represents the average ISS of all trauma patients’ years 2012 through 2018. A significant decrease in patient numbers is noted for years 2015-2016 from previous years, this correlates with a slowing of economic growth in the region. Further this trend is affected by the implementation of AIS 2005. However number of patients seen increases years 2017-2018. The average total ISS for all patients 2012-2018 is 10.86.

Figure 5 - Average ISS of Total Patients 2012-2018
The data presented in the following graph, represents the average ISS score of Major traumas vs the total number of trauma patients. Through the years 2012 to 2018 the average ISS score of Major trauma patients has remained relatively stable with a slight decline in scoring years 2015-2018, as anticipated with the implementation of the AIS 2005 in 2015. The average ISS for major traumas 2012-2014 was 21.34, where average ISS 2015-2018 was 19.07. Therefore not a significant decrease in ISS scoring of major trauma patients.

*AIS 2005 was implemented in 2015 and the change accounts for a drop in qualifying trauma patients.
7.1 **Trauma by Location of Primary Residence**

The volume of trauma patients presenting to the NLRHC from Fort McMurray, the Rural Municipality of Wood Buffalo, other areas within Alberta, and beyond provincial borders is represented in the data below. This is an important reflection of the resources utilized by non-residents of the community, further substantiating the varying population of Fort McMurray due to oil and gas employment/employees.

![Pie chart showing trauma by location of primary residence 2016-2018](image)

*Figure 7 - Trauma by Location of Primary Residence*
7.2 Trauma Team Activation

The following three charts reflect Trauma Team Activation (TTA) data years 2016-2018. Accreditation Canada requires a 90% compliance with Trauma Team Activation. The trauma program has worked to increase education and awareness of criteria for TTA. A consistently high turnover of staff and physicians has proven a challenge in the region. The trauma program has been working with frontline nursing and physicians to improve compliance and reach threshold. Targeting triage, charge, and all Emergency nursing staff whom intake patients.

![Trauma Team Activation - 2016](image)

Figure 8- Trauma Team Activation – 2016
Figure 9 - Trauma Team Activation – 2017

Figure 10 - Trauma Team Activation – 2018
The following data represents a comparison of time to computed tomography (CT) when a TTA occurs and time to CT when the trauma team is not activated. It is apparent that time to CT is increased with activation of the trauma team.

![Trauma Team Activations and Time to CT 2016-2018](image)

*This data excludes patients who did not meet TTA criteria and patients who, if they met criteria did not require a CT scan*
7.3 Age and Gender

According to Statistics Canada (2010), males are most likely to be injured in comparison to females. The chart below represents total number of major trauma 2016-2018 inclusive, percentage of total major trauma, and average age represented by each gender.

![Figure 12 - Gender and Average Age 2016-2018](image-url)
7.4 Trauma by Month of Admission

According to Statistics Canada (2010), nationally, the likelihood of injury correlates with seasonal change. Furthermore, the incidence of injury is slightly higher in summer months. This correlates with the data represented in our region, with July representing the peak of traumatic injury averaging over three years. March and November saw the lowest incidence of major trauma admissions for the region. The graph below demonstrates the trend of total trauma patients by month for 2016-2018.

Figure 13- Trauma by Admission Month
7.5 Day of the Week

Incidence of trauma correlates with days of the week. The below graph demonstrates patient presentation by day of the week 2016-2018. A noted trend displays a decreased incidence of trauma mid-week, with peaks on Friday and Mondays.

Figure 14- Trauma by Admission Day of the Week
The below graph demonstrates the comparison of major trauma by time of day presenting to the NLRHC. As evidenced, the incidence of major trauma is greater in the afternoon, (defined as 1200-1559), and evening hours (defined as 1600-1959).

Figure 15- Time of Day Presenting to ED 2016-2018
Figure 16 - Major Trauma by Time of Day 2016-2018
7.7 Mode of Arrival

The figure below illustrates the means by which patients arrived to the NLRHC post trauma.

![Mode of Arrival 2016-2018](image)

Figure 17 - Mode of Arrival 2016-2018
7.7A Walk-Ins with Major Trauma

In years 2016-2018, 32% of walk in trauma patients were identified as major trauma. Of these, 20% met TTA criteria. As evidenced in the data below there was a small occurrence of missed TTA. Emphasis on identification of TTA at triage has been initiated on site. Education and literature with continued emphasis of early identification through criteria and notification process is provided.

Figure 18 - Walk-Ins with Major Trauma, Criteria Met vs TTA 2016-2018
7.7B  Post ED Disposition

Data represented in the graph below demonstrates patient destination after treatment in the Emergency Department. The greatest amount or 66% (n=96) of trauma patients are admitted to an inpatient unit or the OR at the NLRHC, 33% of trauma patients are transferred to a higher level or specialized care.

![Graph showing post ED disposition](image)

Figure 19 - Post ED Disposition, Regardless of ISS 2016-2018
8.0 Type of Injury

Trauma and injury are of the leading health problems in the world today. Thousands of Canadians suffer from preventable injuries each year. According to the World Health Organization, “Injuries—resulting from traffic collisions, drowning, poisoning, falls or burns - and violence - from assault, self-inflicted violence or acts of war kill more than five million people worldwide annually and cause harm to millions more. They account for 9% of global mortality, and are a threat to health in every country of the world. For every death, it is estimated that there are dozens of hospitalizations, hundreds of emergency department visits and thousands of doctors’ appointments. A large proportion of people surviving their injuries incurs temporary or permanent disabilities.”

World Health Organization.

http://www.who.int/topics/injuries/en/

According to Alberta Health Services, in 2016 alone “1,204 Albertans died from injury, 31,449 required hospitalization and 490,769 were treated in Emergency departments” (Alberta Health: Interactive Data Applications 2018, as cited in Alberta Health Services, 2019).

Injury in Alberta has a significant financial impact, in “2004, injuries cost Albertans $2.94 billion in direct and indirect costs”, further “costs to a seriously injured individual and his or her family are immeasurable” (Alberta Health Services, 2019). Collection and analysis of injury and trauma data, is imperative to supporting regional, provincial and federal injury prevention initiatives.

https://www.albertahealthservices.ca/injprev/Page4791.aspx
Below is a representation of distribution of injury type. Trauma patients presenting with blunt injury (53%) are marginally higher than penetrating injury (44%). Burn injuries are significantly lower, representing 3% of trauma in the region.

Figure 20 - Type of Injury 2016-2018
9.0 Mechanism of Injury

Transport: Any accident involving a device designed primarily for, or being used at the time primarily for, conveying persons or goods from one place to another.

Assault: Injuries inflicted by another person with intent to injure or kill, by any means.

Falls: Includes fall on same level; while being carried or supported; from, out or through a building or structure; jumping or diving into water; etc.

Other: Any injury sustained by neither transport related means, assault, or falls. I.e. suffocation, drowning, burns, etc.

The chart below represents a breakdown of mechanism of injury for all traumas years 2016-2018. As evidenced, a higher incidence of blunt injury exists in the region when all specific mechanism of same are combined.

![Mechanism of Injury Chart]

*Figure 21 - Mechanism of Injury*
9.1 Major Trauma by Mechanism and Age

The age groups most affected by major trauma in the region include ranges 16-29, 30-44, and 45-59.

Figure 22 - Major Trauma by Mechanism and Age Ranges 2016-2018

Transport includes: all motor vehicles, motorcycles
Assaults include: guns
Other Includes: blunt, penetrating, burn, bicycle and pedestrian
9.2 Mechanism of Injury with ISS ≥12

The following graph demonstrates the frequency of type of mechanism of injury in major trauma. As evidenced falls and MVC's account for the bulk of trauma seen in the region.

![Mechanism Of Injury With ISS ≥12 2016 - 2018](image)

Figure 23- Mechanism of Injury with ISS≥12 2016-2018
9.3 Mechanism of Injury with ISS ≥12, Criteria met and TTA called

The following data represents the occurrence of specific mechanism of injury with appropriate TTA. Motor vehicle collisions account for 21% of TTA's, followed by falls at 16%. Blunt, pedestrian, penetrating and bicycle related trauma team activations occur the least in the region at a rate of 5%.

![Figure 24 - Mechanism of Injury with ISS≥ 12, Criteria Met and TTA Called 2016-2018](image-url)
9.4 Place of Injury

Injuries occur in many locations. “For seniors, everyday activities like household chores (27%) and walking (28%) accounted for over half of their injuries. Not surprisingly, work injuries were highest in the population of working-age adults, accounting for about 18% of all their injuries. Other research has found that one-third of all on-the-job injuries occurred among workers in trades, transport and equipment operation” (Statistics Canada, 2010).

The following chart represents the occurrence of major trauma by place and mechanism of injury. The most common mechanism of injury is motor vehicle collision/motor cycle collisions. This most frequently occurs on the highway or roadways, less frequently in or at the home. The majority of fall related and blunt trauma occur within the home.
MAJOR TRAUMA BY PLACE AND MECHANISM OF INJURY
2016 - 2018

<table>
<thead>
<tr>
<th>Place/Activity</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential Inst</td>
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<tr>
<td>Other</td>
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</tr>
<tr>
<td>Trade/Service</td>
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<td></td>
<td>2</td>
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<tr>
<td>Indus/Const</td>
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<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Street/Hwy</td>
<td>17</td>
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<td>5</td>
</tr>
<tr>
<td>Home</td>
<td>1</td>
<td>11</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 25 - Major Trauma by Place and Mechanism of Injury 2016-2018
9.5 Work Related Trauma

From 2016 through 2018, the majority of work related trauma was indicated in the 30-39 year demographic, followed by patients 50-59 years. Patients greater than 60 years of age represent the demographic with the least amount of work related traumatic injuries. Of all work related traumatic injuries seen at the NLRHC only 7% (n=2) were female, and both were between the ages of 20-29.

![Figure 26 - Number of Work Related Trauma by Age, Regardless of ISS, 2016-2018](image)
As indicated in the following data 38% of work related traumatic injury is a result of penetrating trauma. Note all penetrating injuries had an ISS ≤ 12.

Figure 27 - Work Related Trauma by Mechanism of Injury 2016-2018
10.0 Transport Related Trauma

Forms of transport include passenger vehicle, light truck, heavy truck, motorcycle, all-terrain vehicles, snowmobiles and other. According to the Injury Prevention Center (2019), “motor vehicle collisions are among the most deadly, costly, and preventable sources of injury in Alberta”. Further, from 2011-2015 motor vehicle collisions are the third leading cause of provincial injury related deaths and responsible for 309 deaths, 2,493 admissions to hospital, and 27,853 emergency visits across the province (Injury Prevention Center, 2019). Collisions involving motorcycles accounted for “377 hospital admissions and 22 deaths” from 2011-2015 (Injury Prevention Center, 2019).

All-terrain vehicles (ATV’s) are involved in a significant amount of traumatic injury in the province. According to the Injury Prevention Center (2019), between 2002 and 2013, provincially there were 185 ATV related deaths. The financial impact of ATV related trauma has cost the province $16 million dollars a year in direct healthcare costs (Injury Prevention Center).

https://www.injurypreventioncentre.ca/issues/ohv

“ATVs cause more permanent disabilities and death (commonly called “catastrophic injuries”) than most other sport or recreational activities.”

Parachute. http://www.parachutecanada.org/injury-topics/topic/C1
10.1 Mode of Transportation

Light truck mode of transportation, as evidenced in the data below accounts for 28% of transport related injuries. This is closely followed by motorcycles and passenger vehicles.

![Mode of Transportation Resulting in Injury 2016-2018](image)

Figure 28 - Mode of Transportation Resulting in Injury 2016-2018

In 2015, approximately 99% of the Highway 63 twinning project between Grassland and Fort McMurray was completed. See the Alberta Transportation website [https://www.transportation.alberta.ca/4942.htm](https://www.transportation.alberta.ca/4942.htm) for completion dates. This twinning may account for a decrease in transport related trauma in the region from previous years.
11.0 Protective Devices and Injury Prevention

The World Health Organization research has provided clear evidence that certain interventions can prevent injuries, “including:

- seat-belts, helmets and enforced blood alcohol limits to prevent road traffic injuries;
- child-resistant containers to prevent poisonings;
- home hazard modification to prevent falls among the elderly;
- pool fencing to reduce the risk of drowning.” (World Health Organization, 2018)

http://www.who.int/topics/injuries/about/en/

Of all major trauma involving transportation 2016-2018, just over half of patients reported use of a safety device. Safety devices include seatbelts, helmets, airbags, and protective gear.

Figure 29 - Major Trauma and Transportation Safety Device Used (includes cars, trucks, motorcycles and ATVs) 2016-2018
### 11.1 Seatbelts

The figure below demonstrates the use of seatbelts in motor vehicle related trauma years 2016-2018. Just over half of motor vehicle related trauma patients reported wearing a seatbelt at the time of injury.

![Major Trauma - MVC and Seatbelt Usage (excludes motorcycles and ATVs) 2016-2018](image)

*Figure 30 - Major Trauma - MVC and Seatbelt Usage (excludes motorcycles and ATVs), 2016-2018*
11.2 Helmets

“Properly fitted helmet helps protect your brain from absorbing the force from a crash or a fall, dramatically decreasing the risk of serious injury”


The following graph demonstrates helmet use with all major trauma. As evidenced, the instance of major traumatic injury is increased with noncompliance with use.

![Pie chart showing helmet use with major trauma](image)

Figure 31- Major Trauma - Helmets Used with Motorcycles, and ATVs, 2016-2018
11.3 Airbags

The following data demonstrates the number of trauma related motor vehicle collisions (MVC) where airbags deployed, did not deploy or data is unknown.

Figure 32 - Major Trauma - MVC and Airbags (excludes motorcycles and ATV’s), 2016-2018
12.0 Alcohol and Injury

“Persons under the influence of alcohol are more likely to be injured and are more likely to sustain a serious injury” (Injury Prevention Center, 2019). Further, “in Alberta, 3.1% of drivers involved in injury crashes were judged to have consumed alcohol prior to the crash, compared to 19.8% of drivers involved in fatal collisions” (Injury Prevention Center, 2019). Alcohol impairment also contributes to trauma and trauma related death with all-terrain vehicles, from 2002-2013, 51% of ATV drivers killed were over the legal blood alcohol limit of (0.05) (Injury Prevention Center, 2019).

The Injury Prevention Center (2019), further assert alcohol is a factor in fatality related snowmobile incidents, suicidal behavior and spousal abuse injuries.

https://injurypreventioncentre.ca/issues/alcohol

The legal alcohol limit is 11mmol/L (equivalent to 0.05 on a breathalyzer test) while 17mmol/L is equivalent to the 0.08 limit.

The following graph represents the occurrence of positive and negative ETOH (ethyl alcohol) levels in all trauma patients regardless of injury level.

![Graph: ETOH Levels, Regardless of Injury Level 2016 - 2018](image)

Figure 33 - ETOH Levels, Regardless of Injury Level 2016-2018
In the following graph, the data represents the occurrence of all major trauma’s (ISS≥12) with ETOH testing resulting in a positive test, and those not tested.

![Major Trauma (ISS ≥12) with ETOH Testing Positive VS. Not Tested 2016 - 2018](image)

Figure 34 - Major Trauma (ISS ≥12) with ETOH Testing, Positive vs. Not Tested 2016-2018

As evidenced below, of all traumas 2016-2018 with an ETOH level ≥ 17 mmol/L, 52% were penetrating injury and 48% were blunt injury.

![ETOH ≥17mmol/L and Blunt vs. Penetrating Injury 2016 - 2018](image)

Figure 35 - ETOH ≥ 17mmol/L and Blunt vs. Penetrating Injury 2016-2018
13.0 Emergency Department Trauma Procedures

The Emergency department is equipped to manage immediate trauma care. The following graph shows the frequency of most commonly performed procedures on trauma patients in the Emergency Department, and trauma patients in Diagnostic Imaging 2016-2018.

![Procedures in ER and DI, 2016-2018](image-url)
13.1 Diagnostic Imaging Trauma Procedures

The following graph demonstrates the type and frequency of computed tomography (CT) and magnetic resonance imaging (MRI) procedures, indicated for major trauma patients. Of all CT procedures, CT head accounted for 30% of procedures. In very few cases MRI Brain and Spine were utilized accounting for only 2% of all diagnostic CT and MRI combined. The average number of radiological procedures per trauma patient is 2.4.

![CT Scans/MRI Procedures 2016-2018](image)

*Figure 37 - CT Scans/MRI Procedures 2016-2018*
14.0 Patient Discharge Disposition

Of all major traumas received at the NLRHC Emergency department, 49% were transferred to a higher level of care. Of the remaining; 49% were admitted to an inpatient bed at the NLRCH, with 2% recorded as a death.

Figure 38- Major Trauma - ED Patient Discharge Disposition, 2016-2018
14.0A Inpatient Discharge Disposition

Of all major trauma patients admitted to an inpatient bed at the NLRHC 56% were subsequently discharged home, 33% were transferred to another facility for advanced or specialized care. Death and transfer to a remand facility account for the remaining dispositions.

Figure 39 - Major Trauma (ISS ≥12) Inpatient Discharge Disposition, 2016-2018
14.0B Destination of Transferred Patients ED and Inpatient

The graph below represents the distribution of receiving trauma centres for patients transferred out of the NLRHC. The University of Alberta Hospital is the primary Level I receiving site for adult trauma and the Stollery for pediatric trauma patients.

Figure 40 - Transfer Destination of Major Injuries (From ED and From Inpt), 2016-2018
15.0 Admission Service

The Trauma Association of Canada recommends in the absence of a dedicated Trauma Unit, the surgical unit should be designated to cohort trauma patients together, unless intensive care is required. Ideally, all admitted trauma patients would also be admitted under an intensivist or surgeon. The following data demonstrates the dispersion of trauma patients admitted to the NLRHC. For year 2016, 21% of all trauma admissions are undocumented, as the data was not collected for this time.

Figure 41 - Inpatient Admission to Hospital Ward 2016*, 2017, 2018
15.1 ED Length of Stay by Discharge Disposition

The following data represents the Median length of stay by discharge disposition years 2016-2018.

<table>
<thead>
<tr>
<th>ED Discharge to:</th>
<th>Number of Patients:</th>
<th>Median LOS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferred Out</td>
<td>47</td>
<td>3 H 55 M</td>
</tr>
<tr>
<td>Surgery Unit</td>
<td>44</td>
<td>5 H 29 M</td>
</tr>
<tr>
<td>ICU</td>
<td>16</td>
<td>3 H 36 M</td>
</tr>
<tr>
<td>Medical Unit</td>
<td>6</td>
<td>7 H 13 M</td>
</tr>
<tr>
<td>Pediatric Unit</td>
<td>3</td>
<td>3 H 56 M</td>
</tr>
<tr>
<td>Expired</td>
<td>1</td>
<td>0 H 8 M</td>
</tr>
<tr>
<td>Floor, NFS*</td>
<td>20</td>
<td>4 H 42 M</td>
</tr>
<tr>
<td>Direct Admit**</td>
<td>7</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*2016 Data Analyst did not record the Nursing Unit

**Patients Admitted for surgical intervention (penetrating injury)

15.2 ED Length of Stay by ISS

The following data represents Emergency department median length of stay by Injury severity score (ISS), years 2016-2018.

<table>
<thead>
<tr>
<th>ISS</th>
<th>Number of Patients:</th>
<th>Median LOS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>All ISS</td>
<td>137*</td>
<td>4 H 43 M</td>
</tr>
<tr>
<td>ISS 0 - 11</td>
<td>58</td>
<td>4 H 2 M</td>
</tr>
<tr>
<td>ISS 12 - 15</td>
<td>25</td>
<td>5 H 51 M</td>
</tr>
<tr>
<td>ISS 16 - 19</td>
<td>24</td>
<td>4 H 37 M</td>
</tr>
<tr>
<td>ISS 20 - 24</td>
<td>14</td>
<td>5 H 0 M</td>
</tr>
<tr>
<td>ISS 25 - 40</td>
<td>15</td>
<td>4 H 1 M</td>
</tr>
<tr>
<td>ISS 41 - 74</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td>ISS 75</td>
<td>1</td>
<td>2 H 14 M</td>
</tr>
</tbody>
</table>

*excludes 7 direct admission cases, all bypassed the Emergency department
### 15.3 Trauma Centre Length of Stay by ISS

The below table demonstrates the inpatient median length of stay (LOS) by ISS years 2016-2018.

<table>
<thead>
<tr>
<th>All ISS</th>
<th>Number of Patients:</th>
<th>Median LOS:</th>
<th>Range:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISS 0 - 11</td>
<td>57</td>
<td>2</td>
<td>01-50 days</td>
</tr>
<tr>
<td>ISS 12 - 15</td>
<td>16</td>
<td>3.5</td>
<td>01-14 days</td>
</tr>
<tr>
<td>ISS 16 - 19</td>
<td>9</td>
<td>4</td>
<td>01-10 days</td>
</tr>
<tr>
<td>ISS 20 - 24</td>
<td>5</td>
<td>5</td>
<td>02-09 days</td>
</tr>
<tr>
<td>ISS 25 - 40</td>
<td>9</td>
<td>2</td>
<td>01-11 days</td>
</tr>
<tr>
<td>ISS 41 - 75</td>
<td>0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>
16.0 Mortality Rates by ISS

From 2016-2018 there have been four deaths related to major trauma in the region, all with an ISS ≥16 but not exceeding 40. The following data represents mortality by ISS over years 2011-2018.

Figure 42 - Mortality by ISS 2011-2018
17.0 Post Transfer Complications

According to the Canadian Institute for Health Information’s, National Trauma Registry Comprehensive Dataset – Data Dictionary (2012), A complication or complications can arise “after the beginning of hospital observation and/or treatment that usually has a significant influence on the patient’s hospitalization (length of stay) and/or the patient’s management or treatment”.


Below is the data for reported complications of major traumas transferred from NLRHC to Level I and II facilities.

Figure 43 - Complications of Major Traumas Recorded by Level I and II Facilities, ISS ≥ 12
All complications recorded by the NLRHC 2016-2018 for major traumas ISS ≥ 12 are represented in the following graph.

Figure 44 - Complications of Major Traumas Recorded by NLRHC, ISS ≥12
17.1 Performance Improvement and Patient Safety (PIPS)

NLRHC actively participates in Performance Improvement and Patient Safety (PIPS) program. An extensive chart review for all trauma patients with an ISS ≥ 12, or any called or missed Trauma Team Activations. By utilizing built in audit filters within the collector, as well as external performance indicators, charts are retrospectively reviewed by the trauma coordinator to identify any issues that may affect the quality of patient care. When issues are identified, the review is taken to the PIPS committee, comprised of the Trauma Medical Director, Trauma Coordinator and Manager of the Emergency Department for further review. Issues are resolved by:

- Speaking with healthcare provider directly
- EMS issues are taken to EMS directors by the Trauma Medical Director
- Education and policy development for identified issues becoming trends in patient care
- Collaboration with The Emergency/ICU Quality Nurse
### 17.2 Audit Filters

The Trauma Association of Canada (TAC) requires a comprehensive trauma registry, as part of the guidelines for an accredited trauma system/trauma center. Alberta utilizes the Alberta Trauma Registry (ATR) for data collection. Audit filters are the provincial filters utilized by the ATR guiding data collection.

<table>
<thead>
<tr>
<th>Audit Filters</th>
<th>NA</th>
<th>NO</th>
<th>UNKNOWN</th>
<th>YES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>At any point during the patient's stay, did the patient have any unplanned return to the OR for the same single body system procedure?</td>
<td>44</td>
<td>95</td>
<td>3</td>
<td>2</td>
<td>144</td>
</tr>
<tr>
<td>Did patient die during transport?</td>
<td>141</td>
<td>3</td>
<td></td>
<td></td>
<td>144</td>
</tr>
<tr>
<td>Did the patient have any missed injuries that subsequently require surgery?</td>
<td>134</td>
<td>8</td>
<td>2</td>
<td></td>
<td>144</td>
</tr>
<tr>
<td>Did the patient spend more than 2 hours at any hospital outside of Trauma Center?</td>
<td>133</td>
<td>8</td>
<td>3</td>
<td></td>
<td>144</td>
</tr>
<tr>
<td>For all patients assessed/treated in the ED, is minimum q 1h documentation present in the medical record, from arrival in the ED until admission (to the OR, ICU or other unit), death, or transfer to another hospital? This includes time spent in d</td>
<td>10</td>
<td>20</td>
<td>114</td>
<td></td>
<td>144</td>
</tr>
<tr>
<td>For all patients assessed/treated in the ED, with a diagnosis of skull fracture, intracranial injury or spinal cord injury, is sequential neurological documentation present in the ED record?</td>
<td>117</td>
<td>6</td>
<td>2</td>
<td>19</td>
<td>144</td>
</tr>
<tr>
<td>For all patients with an acute epidural or subdural hematoma, was a craniotomy done more than 4 hours after arrival in the ED?</td>
<td>142</td>
<td>2</td>
<td></td>
<td></td>
<td>144</td>
</tr>
<tr>
<td>For all patients with prehospital care provider(s), are all prehospital ambulance reports from all phases of patient transport present on the medical record?</td>
<td>62</td>
<td>18</td>
<td>1</td>
<td>63</td>
<td>144</td>
</tr>
<tr>
<td>If patient had a femur fracture and was stable, was operative repair of the fracture done more than 24 hours after arrival in ED?</td>
<td>142</td>
<td>1</td>
<td>1</td>
<td></td>
<td>144</td>
</tr>
<tr>
<td>If patient sustained a gunshot wound to the abdomen, was he/she managed non-operatively?</td>
<td>141</td>
<td>2</td>
<td></td>
<td>1</td>
<td>144</td>
</tr>
<tr>
<td>If the patient died, did he/she die within first 24 hours of arrival in the ED?</td>
<td>140</td>
<td>2</td>
<td>2</td>
<td></td>
<td>144</td>
</tr>
<tr>
<td>If the patient required a category one laparotomy, was it performed more than 1 hour after arrival in ED?</td>
<td>142</td>
<td>2</td>
<td></td>
<td></td>
<td>144</td>
</tr>
<tr>
<td>If the patient sustained grade III open fracture of the radius, ulna, humerus, tibia, fibula, and/or femur, and was stable, was operative repair within 8 hours of arrival to trauma center?</td>
<td>143</td>
<td>1</td>
<td></td>
<td></td>
<td>144</td>
</tr>
<tr>
<td>If there was a trauma team activation (TTA), did the trauma response time exceed 20 minutes?</td>
<td>109</td>
<td>31</td>
<td>1</td>
<td>3</td>
<td>144</td>
</tr>
<tr>
<td>Was a trauma patient admitted to hospital under any physician other than a surgeon or an intensivist?</td>
<td>46</td>
<td>79</td>
<td>19</td>
<td></td>
<td>144</td>
</tr>
<tr>
<td>Was there a diagnosis of c-spine injury 48 hours after admission or at discharge/death if patient discharged/died within 48 hours?</td>
<td>18</td>
<td>124</td>
<td>2</td>
<td></td>
<td>144</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>1664</td>
<td>398</td>
<td>9</td>
<td>233</td>
<td>2304</td>
</tr>
</tbody>
</table>
Review of the audit filter results from previous years helps guide the education and goals of the Trauma Program. Documentation, TTA response, and EMS PCR compliance have been and continue to be a priority.
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Figure 42 - Mortality by ISS 2011-2018

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