WASHINGTON STATE DEPARTMENT OF HEALTH

DRAFT: 2024 Washington State Trauma Services Assessment

An assessment of the trauma care and services in Washington State

Washington State Department of HEALTH

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Executive Summary

The Washington Trauma Services Assessment aims to investigate and summarize the demand for, accessibility, timeliness quality and cost associated with Trauma Services in Washington State. Its intended use is as a tool for state and regional trauma system planning. This assessment is developed by the Washington State Department of Health (department) in collaboration with external partners and once final, will be revised and updated every two years.

Background

Washington's EMS and Trauma Care System aims to assure that the required resources are available, and the necessary infrastructure is in place to deliver the “right” patient to the “right” facility in the “right” amount of time. The system is built upon broad input, consensus, and collaboration among diverse groups and around complex logistical, political, financial, legal, and medical issues.

Hospitals that provide trauma care (trauma services) are a critical component within The Washington EMS & Trauma Care System. Currently Washington has 84 designated trauma services across eight EMS & Trauma Care Regions. Each region convenes an EMS & Trauma Care Council responsible for developing and maintaining regional EMS & Trauma Care Plans (regional plans) used to assess and analyze regional needs around care and resources for time sensitive emergencies. These regional plans are used by the department as a basis by which to establish the minimum and maximum numbers and level of trauma services needed within the region based on the availability of resources and distribution of trauma within the region. (RCW 70.168.100 and RCW 70.168.060)

Past efforts to assess Washington’s EMS & Trauma Care System and identify methods for resource allocation include a statewide assessment conducted by the American College of Surgeons (ACS) in 2019, a series of public forums where broad input from system partners and interested parties was collected, a department led workgroup comprised of Trauma Medical Directors and key external partners in 2020. This work was followed by an effort to codify a proposed methodology for resource allocation through a contentious rulemaking process in 2023, which resulted in maintaining existing rules and the establishment of this assessment. This assessment will draw on these past efforts as well as include further input from external partners to provide a continual understanding of resources and system needs throughout the state.

Approach

The Washington Trauma Services Assessment will be a process developed and led by the department biennially with input from key stakeholders including the Washington State EMS & Trauma Care Steering Committee, Trauma Medical Directors, and the EMS and Trauma Outcomes Technical Advisory Committee (TAC). The scope and focus of this assessment is limited to trauma services in Washington; however, future assessments may expand to include other components that make up the EMS & Trauma / Emergency Care System including Emergency Medical Services (EMS), Cardiac and Stroke categorization, trauma rehabilitation, pediatric trauma services, injury & violence prevention and emergency response and preparedness.

This assessment includes guidance for Regional EMS and Trauma Care Councils on use of this assessment and additional confidential data to inform biennial regional planning processes and regional plans. During the regional planning process, the regional council makes recommendations to the Washington State EMS & Trauma Care Steering Committee and the department for the need and

distribution of trauma designated services needed to support the region. Upon advice and recommendations from the regional councils and the EMS & Trauma Care Steering Committee, the department, who is the approving authority, makes final determinations and a chart of the minimum and maximum number of trauma designated services for each designation level is updated and provided in the regional plan.

Objectives:

Overall Aim: Assess trauma services in the state of Washington for gaps in services and provide data for informed decision-making at the state and regional levels.

Objective 1) Assess and describe the current resources and state of demand for trauma services.

Objective 2) Provide a base for regional councils to understand the current state of trauma care and reflect on needed changes to their region.

Objective 3) Assess the cost associated with trauma services.

Objective 4) Project the future demand for trauma services.

Key Findings

1) The population of Washington State is growing, representing a potential increase in trauma incidents and demand on trauma services statewide.
2) Trauma incidents are increasing more rapidly than the population, reinforcing the likely need for increased availability of services in future years.
3) The number of Trauma services has not increased or varied greatly over the past 10 years, despite a continually increasing patient volume.
4) Some level of trauma services (Level I thru V) is accessible to most Washingtonians within 60-minutes, though fewer have access to higher levels of care (Levels I and II) within 30 minutes, as is prescribed in the Washington State Trauma Triage Guidelines for severe trauma.
5) The average time to initial trauma care across the state is approximately 60-minutes, while definitive care is reached on average in 85 minutes. While these times are consistent with current benchmarks, there is variation across regions where geographic distances from higher levels of care pose a possible barrier to efficient care delivery.
6) In-hospital mortality has been slightly decreasing, with little variation between trauma services across the state, demonstrating a consistency in quality of care throughout the trauma system.

Limitations

The most recent trauma patient data available at the time of this assessment is from 2019. This represents a gap of 4-years of data and is due to a failure of the vendor for the existing system to comply with Washington Technology Solutions (WATech). (Technology Standard 183.20.10 for Identity Management User Authentication). The department is exploring solutions to replace the existing data registry with a modernized registry that would meet state security standards. The assessment will be updated as soon as more recent data is available. Timelines and updates regarding this data limitation will be communicated to interested parties as they develop.

As provided in RCW 70.168.090, data related to a patient, provider and facility care outcomes is confidential. To comply with this restriction, this assessment does not include information on specific facility volumes and care which may limit its utility in identifying specific needs for trauma services across the state. Facility-level information may need to be studied and discussed within appropriate forums where our laws provide the legal context to do so, such as the Regional EMS & Trauma Quality Assurance Committee. The department has included guidance regarding this nuance in this assessment.

Key metrics important in determining the need for additional trauma resources are not currently available for study. These include the specific subspecialty services provided during patient care, rationale for transferring a patient, reason for bypassing a facility and more detailed outcomes. These metrics are either not collected in the Trauma Registry or are collected at too broad of detail to adequately inform the need for additional resources. Possible options to resolve this gap include regional data collection and review or inclusion of needed data elements in the Trauma Registry reporting requirements.

Background

Washington EMS & Trauma Care System History

In 1990, legislation was enacted which called for the development of a comprehensive statewide EMS & trauma care system. This legislation was the culmination of a series of initiatives which began in the late 1960s with the University of Washington pioneering the development of paramedic training programs. Efforts continued through the 1970s when legislation was enacted that directed the department to develop minimum standards for training and certification of prehospital providers, licensing standards for EMS services. The work to establish the regulatory framework for the system continued in the late 1980s with the completion of the "Washington State Trauma Patient Tracking Study," and development of the 1990 Washington State Trauma Project: A Report to the State Legislature which informed the development of Trauma Care Systems Act.

The key components of the Trauma Care Systems Act, include:

- Clear lines of authority and responsibility;
- Designation of Trauma Care and Trauma Rehabilitation services;
- Trauma Care services;
- Verification of Prehospital Trauma services;
- Field triage criteria development;
- Regional planning and implementation;
- Cost containment considerations;
- Integration of trauma/injury prevention;
- Trauma registry development;
- Establishment of regional quality assurance/improvement programs;
- Integration of trauma rehabilitation services; and,
- Evaluation of system effectiveness.

Washington's EMS and Trauma Care System aims to assure that the required resources are available, and the necessary infrastructure is in place to deliver the “right” patient to the “right” facility in the “right” amount of time. The system is built upon broad consensus and cooperation among diverse

groups and around complex logistical, political, financial, legal, and medical issues. It's a comprehensive system that includes a strong injury prevention component as well as the designation of rehabilitation services for post-acute care.

Intent

As provided in RCW 18.73.010 and RCW 70.168.10, the Legislature enacted the regulatory framework of the system because trauma is a severe health problem in the state of Washington and a major cause of death. The Washington Trauma Care System is necessary to promote health, safety, and welfare of the people in this state. It is in the best interest of the people in Washington state to establish and promote an efficient and well-coordinated statewide emergency medical services and trauma care system to reduce costs and incidence of inappropriate and inadequate trauma care and emergency medical service and minimize human suffering and costs associated with preventable mortality and morbidity.

The goals and objectives of the system are to pursue trauma prevention activities to decrease the incidence of trauma, provide optimal care for the trauma victim, prevent unnecessary death and disability from trauma and emergency illness, and contain costs of trauma care and trauma system implementation.

Such a system provides a timely and appropriate delivery of emergency medical treatment for people with acute illness and traumatic injury and recognizes the changing methods and environment for providing optimal emergency care throughout Washington State.

Structure

The Washington EMS and Trauma Act of 1990 created three major groups of participants: the Department of Health's Office of Emergency Medical Services and Trauma System, the EMS and Trauma Care Steering Committee and the eight EMS and Trauma Care Regions.

State responsibilities include establishing standards and managing designation of trauma and rehabilitation services, coordination of injury prevention programs, regulation of EMS providers, standards for education of EMS personnel and training programs, management of a trauma registry and quality improvement programs, establishment of trauma triage criteria, patient care protocols, destination guidelines and administration of the Trauma Care Fund.

Emergency and Disaster Preparedness

The Trauma System plays a critical role in emergency and disaster preparedness. All trauma hospitals are responsible for coordinating patient care in a disaster where multiple people may be critically injured and in need of care. In Washington, Disaster Management Coordination Centers (DMCCs) provide regional coordination of patient transport and bed capacity for such mass casualty incidents. Located in or near Emergency Departments of selected hospitals, DMCC's provide a place for medical personnel to coordinate patient movement during an incident to maintain a balance of patients and care across the system. Preparedness for such an incident is reliant on proactive planning, coordination and data collection to ensure the right information is on hand and resources are available for care during an event.

In assessing state and regional trauma resource needs, the ability of the system to respond to an emergency or disaster is critical. Areas of consideration should include:

Mass Casualty Triage: Implementation of mass casualty triage protocols to prioritize patients based on the severity of their injuries and the likelihood of survival.

Surge Capacity: Development and maintenance of plans to expand capacity rapidly to handle a sudden influx of patients. This includes strategies for increasing bed capacity and mobilizing additional healthcare providers.

Patient Transfer and Coordination: Inter-hospital Coordination: Establishment of protocols for the transfer of patients to and from other healthcare facilities to balance patient loads and optimize care.

Evacuation Plans: Development of evacuation plans for moving patients to safety in case the hospital itself is compromised.

Resource and Capacity Data to include:

- Bed Availability: Monitoring of real-time bed occupancy rates and the availability of critical care, emergency, and general ward beds.
- Supply Levels: Tracking inventories of essential medical supplies, medications, and equipment to ensure preparedness and identify shortages.
- Staffing Levels: Recording the number of available healthcare providers, including doctors, nurses, and support staff, during different shifts and emergencies.

The department is evaluating what data and information is available that could be included in future iterations of this assessment to support planning in these areas. Potential sources for this information include WA TRAC, WA HEALTH and administrative records.

Current State

The Washington Trauma System currently has 84 designated trauma centers across eight EMS and Trauma Regions. (Figures 1 and 2) Each region convenes an EMS and Trauma Care Council, responsible for maintaining regional EMS and trauma care plans, which among other purposes, are intended to assess and analyze regional needs around care and resource needs, and used by the department as a basis by which to establish the number and level of trauma centers to be designated in the region based on the availability of resources and distribution of trauma incidents within the region. (RCW 70.168.100 and RCW 70.168.060)

2024 Designated Trauma Centers	*Acute Care*	*Pediatric*
Level I	1	1
Level II	6	2
Level III	23	6
Level IV	36	
Level V	13	

Figure 1 Number of Trauma Centers, Statewide, 2024

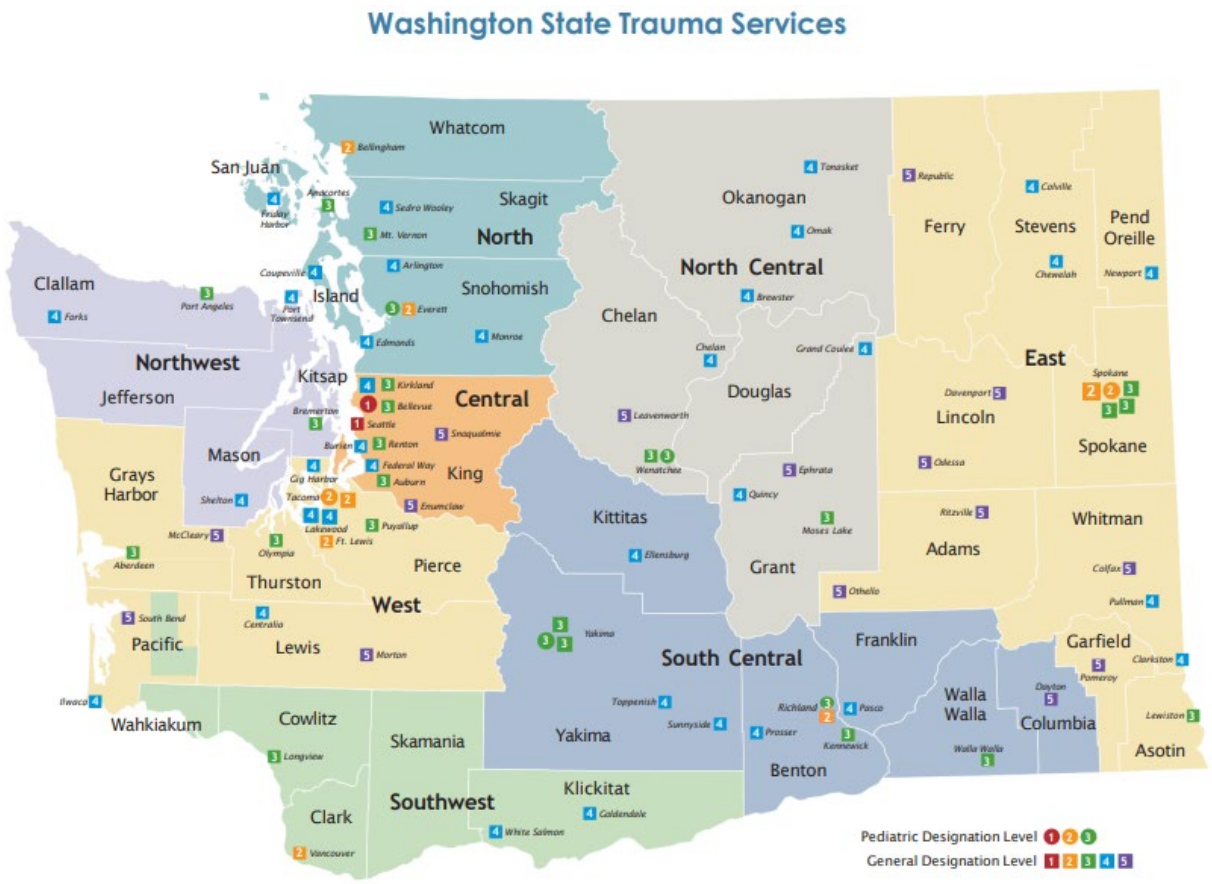


Figure 2 Map of EMS and Trauma Regions and Trauma Centers in Washington State

Recent History of the Statewide EMS & Trauma Care System Assessment

2019 ACS Assessment

In April of 2019, the American College of Surgeons (ACS) assessed Washington's current system. As part of that assessment, the department then held five public forums across the state to engage stakeholders and gather community feedback on the assessment from EMS and Trauma care providers, community members, legislators, Tribes, and others. The assessment and forums yielded a list of recommendations for improving the Washington Trauma System. These recommendations include the need to

1) Perform a formal data-based gap analysis of the Washington State Trauma System and
2) Develop and disseminate a standard Trauma System Report for the lead agency and regional system stakeholders to drive Emergency Care System (ECS) Strategic Plan advancement.
3) Establish an objective and standardized statewide process to revise the Minimum and Maximum criteria for all trauma designation levels.

This assessment is intended to address these three recommendations by developing a statewide assessment of the trauma system that may be used to, among other purposes, review and establish minimum and maximum criteria for trauma designation levels.

2020 Trauma Medical Directors Workgroup

To act on the ACS EMS & Trauma Care System Assessment and forum recommendations, the department created the Min/Max Workgroup. The workgroup met from February 2020 through May 2020 with a goal to develop an evidence-based methodology the department could use to determine the statewide minimum and maximum numbers of Level I and Level II trauma services the state needs to optimize patient outcomes. The department appointed trauma medical experts from across the state to participate on the Min/Max Workgroup and provide their expertise. The workgroup resulted in a recommendation however, the result of this work was inconclusive of a defined methodology and it was determined that there was a need to establish rules to further this work.

2023 Rulemaking Trauma Designation Standards

The department conducted rulemaking in 2023 towards the same goal but were unable to achieve consensus amongst stakeholders for a defined methodology for determining the need and distribution of trauma services during the rulemaking process. As a result, the department rescinded the proposed standards (WSR23-11-166) for WAC 246-976-580 - Criteria for Trauma Designation on October 30, 2023.

2024 Trauma Services Assessment

A common theme within each of these past efforts was the need to assess the distribution of trauma services and gaps in care in Washington. To meet this need, the department initiated a statewide effort to assess trauma services inclusive of all previous work as a backdrop, that could be used to inform state and regional planning activities for recommending the need and distribution of trauma services around the state. The initial assessment began in January 2024 and is currently in draft form until additional components are added. Once final, updates to the assessment are expected to occur every two years to align with the biennial regional planning cycles that the Regional EMS & Trauma Care Councils conduct as required by our law.

Department of Health staff led efforts to facilitate the work, convene stakeholders and develop the assessment. Many representatives of the Emergency Care System (ECS) provided valuable input and recommendations toward determining the trauma need in Washington through the ACS assessment, Min/Max Workgroup and Trauma Designation rulemaking process. This effort to develop a statewide Trauma Services Assessment built upon those past contributions and seeks to further support and inform decision making in the system moving forward.

In addition to seeking input from ECS partners and other interested parties, the department sought feedback from three trauma system experts residing outside of the state of Washington, to garner input and insight from another perspective to support of our effort. A summary of recommendations and the full reports from the external experts are included in Appendix G.

Within this assessment process, there are three distinct roles:

- Department of Health – Develop and conduct the assessment. Seek recommendations from the EMS & Trauma Care Steering Committee and Regional Councils and make final determinations on the need and distribution of trauma services within the state.
- Regional EMS and Trauma Councils – Leverage information from the assessment to inform regional planning activities and submit regional plans to the department.
- EMS and Trauma Steering Committee – Review, provide input and make recommendations on Regional EMS and Trauma Care Plans to the department.

Objectives

Overall Aim: Assess trauma services in the state of Washington for gaps in services and provide data for informed decision-making at the state and regional levels.

Objective 1) Assess and describe the current resources and state of demand for trauma services.

This assessment assesses the current state of both the demand and availability of trauma services. It describes the current and projected population and injury patterns in Washington and assesses the availability, timeliness, and outcomes of trauma care. It also describes the impacts of changes to the trauma system on costs in the overall health care system.

Objective 2) Provide a base for regional councils to understand the current state of trauma care and reflect on needed changes to their region.

The primary use of the assessment is for state and regional council planning purposes. Each EMS and Trauma Care Council is responsible for developing and maintaining regional EMS and trauma care plans, which must be updated every two years. These plans, among other purposes, are intended to assess and analyze regional needs around care and resources, and to inform the departments decisions around the number and level of trauma centers to be designated in the region. The Trauma Services Assessment is intended as an aid to Regional Councils, in identifying and planning for these needs. The assessment provides both data and information to support decision-making.

Limitations

Data availability:

The most recent trauma patient data available at the time of this assessment is from 2019. This represents a gap of 4-years of data. This data limitation is due to a failure of the current trauma registry vendor supported data system to comply with Washington Technology Solutions (WaTech) Technology Standard 183.20.10 for Identity Management User Authentication. Efforts have been underway since 2021 to resolve this issue and bring the data system back into compliance. The department is exploring solutions to replace the existing data registry with a modernized registry that would meet state security standards.

While more recent data is preferred, the department will use the most recently available data to support understanding of the trauma services component of the EMS & Trauma Care System. In the case of this assessment, 2019 data is the most recent trauma data available, while other data sources included in this assessment have more recently available information, which will be used concurrently. While health data from multiple sources will be compared over the same time periods, information for planning purposes, such as the number of designated trauma services at each level, is assessed using current information. Therefore, in this assessment, maps and charts will display 2024 trauma services along with 2019 trauma incident distribution.

The assessment will be updated as soon as more recent data is available. Timelines and updates regarding this data limitation will be communicated to interested parties as they develop.

Data confidentiality:

Per RCW 70.168.090, data related to a patient's, provider's and facility's care outcomes is confidential. This restriction prevents public facing reports, including the Trauma Services Assessment, from

disclosing a hospital's identity either directly or indirectly. While the intent of this assessment is to provide information for state and regional planning, it is not able to include information on specific facility volumes and care, limiting its utility in defining specific needs for designation changes across the state. This publicly available assessment focuses on broad trauma patterns and needs both statewide and regionally, however, more specific facility-level information may need to be studied and discussed within appropriate forums where our laws provide the legal context to do so, such as the Regional EMS & Trauma Quality Assurance Committee. The department has included guidance regarding this nuance in this assessment.

Data on subspecialty services & transfer rationale:

Several key performance improvement metrics, important in determining the need for additional trauma resources, are not currently available for study in Washington State. These include the specific subspecialty services provided during patient care, rationale for transferring a patient, reason for bypassing a facility and more detailed outcomes. These metrics are either not collected in the Trauma Registry or are collected at too broad a detail to adequately inform the need for additional resources.

While assessing the state and regional transfer patterns is informative for better understanding the state and function of the trauma component of the system, rationale behind transfers to a higher level of care and bypass to a higher level of care would indicate whether existing services lack the necessary resources to provide care as intended. For instance, a transfer from a level II facility to a level I facility, whose clinical provisions are intended to be equivalent, may indicate a need for additional clinical resources at the level II facility. However, without the transfer rationale, it is unknown whether the transfer was due to a gap or within the intended design of the trauma system.

Furthermore, the provision of subspecialty services has been identified by stakeholders as a critical distinction in higher levels of trauma care and maintaining a balanced volume of patients receiving subspecialty services critical to the system's success. Currently, information collected in the Trauma Registry regarding the subspecialty care provided to a trauma patient lacks the specificity to adequately inform a needs-based analysis.

These data limitations may be addressed in several ways, including focused and routine collection and review of these metrics by regional quality assurance committee or adding these data elements to the Trauma Registry reporting requirements.

Assessment

This assessment looks to answer six key questions related to the population, accessibility, timeliness, outcomes, and cost, each with findings summarized below. Beyond the five key questions it is recommended that Regional EMS and Trauma Care Councils use an additional series of questions to guide their regional analysis for local planning. These questions require facility specific information that is not publishable in a public report but can be requested from the department and shown in confidential meetings and communications among the Regional EMS and Trauma Quality Assurance Committees. These programs collaborate and provide input into regional planning activities for their respective Regional EMS and Trauma Care Councils. All data tables (Appendix E) and regional level data figures (Appendix F) are provided in the appendix at the end of this document.

Following this summary, each question is addressed in more detail.

How is Washington's population changing and how do trauma volumes and injuries compare to that change?

Washington's population is on the rise and that is expected to continue with a 6.6% increase anticipated between 2020 and 2030. While the population is growing, the rate of trauma incidents is increasing even faster with a 50% trauma incident rate increase between 2010 and 2019. A growing aging population also has an impact on the demands for the trauma system, which has seen a marked increase in both fall injury rates and geriatric patients for some time.

How accessible is trauma care in WA?

Much of the state's population (99%) is within an hour from some level of trauma care (Level I thru V). Though fewer (84%) have access within an hour from a level I or II facility. 35% of severe trauma incidents, which often require a higher level of care, occurred further than 30 minutes from a level I or II trauma facility. While most patients do not end up being transferred to a higher level of care, patient transfers out of the EMS and Trauma Region are most frequent among level V facilities while most patients transferred in for care from another region are going to the Level I trauma center.

How long does it take to get appropriate trauma care?

How quickly a patient receives care after an injury is one of the most critical factors in trauma care. To assess this the time to care can be broken into segments:

Time from EMS Notification to Scene Departure: In 2019, the average time from EMS being notified by dispatch to EMS departing the scene of the injury with the patient was 29.2 minutes.

Time from Scene Departure to arrival at initial facility: In 2019, the average time from EMS departing the scene with the patient to arriving at the initial facility was 33 minutes.

Combined, the average time from EMS notification of an incident to the patient arriving at the initial facility was 60.2 minutes. I 2019, 64 percent of patients arrived at the initial facility within 60 minutes of injury.

Time from EMS Notification to Definitive Care: In 2019, the average time from injury to definitive care at the final facility was 85.6 minutes. This average includes those who were transferred to a higher-level facility and those who remained at their initial facility. Time to definitive care is

substantially longer for patients who are transferred, than for patients who remain at their initial facility and longer still for those transferred outside of the EMS and Trauma region.

Is the Washington State EMS & Trauma Care System reducing mortality in injured patients?

Overall, after adjusting for age, in-hospital mortality rates among trauma patients have been in a slight decline between 2009 and 2019. Risk adjusted in-hospital mortality showed little to know differences between facilities and between facilities, though one higher level center was found to have lower than average mortality while one level III center was found to have higher than average.

How does a changing the system affect costs in the overall healthcare system?

Overall health care costs in Washington and nationally continue to rise at rates higher than inflation, impacting the ability for individuals to pay for services and access the care they need. Understanding how any change to the health care system, including a change in trauma designation for a facility, impacts the cost of care across the system, including non-trauma services, is an important factor to review when assessing trauma designation levels. The final trauma assessment will include analysis of the impact on costs to the health care system due to changes in facility trauma designation.

What will future demands be for the Washington EMS & Trauma Care System?

Incidents of traumatic injury and overall population in Washington State have continued to rise. To adequately plan for necessary resources a forecast of trauma need is planned in collaboration with the Washington Office of Financial Management. This forecast will be included in the final trauma assessment.

Population and Injury

Summary: Washington's population is on the rise and that is expected to continue with a 6.6% increase anticipated between 2020 and 2030. While the population is growing, the rate of trauma incidents is increasing even faster with a 50% trauma incident rate increase between 2010 and 2019. A growing aging population also has an impact on the demands for the trauma system, which has seen a marked increase in both fall injury rates and geriatric patients for some time.

Key Question: How is Washington's population changing and how do trauma volumes and injuries compare to that change?

Population, trauma volume and trauma hospitals

In 2020, Washington State had nearly 8 million residents. That number is projected to increase by 6.6%, to nearly 8.5 million by 2030. All but two Washington counties are expected to grow in population between 2020 and 2030 with the highest percent growth expected for Clark and Franklin counties and a decline in population in Columbia and Garfield counties over that time. (Figure 3)

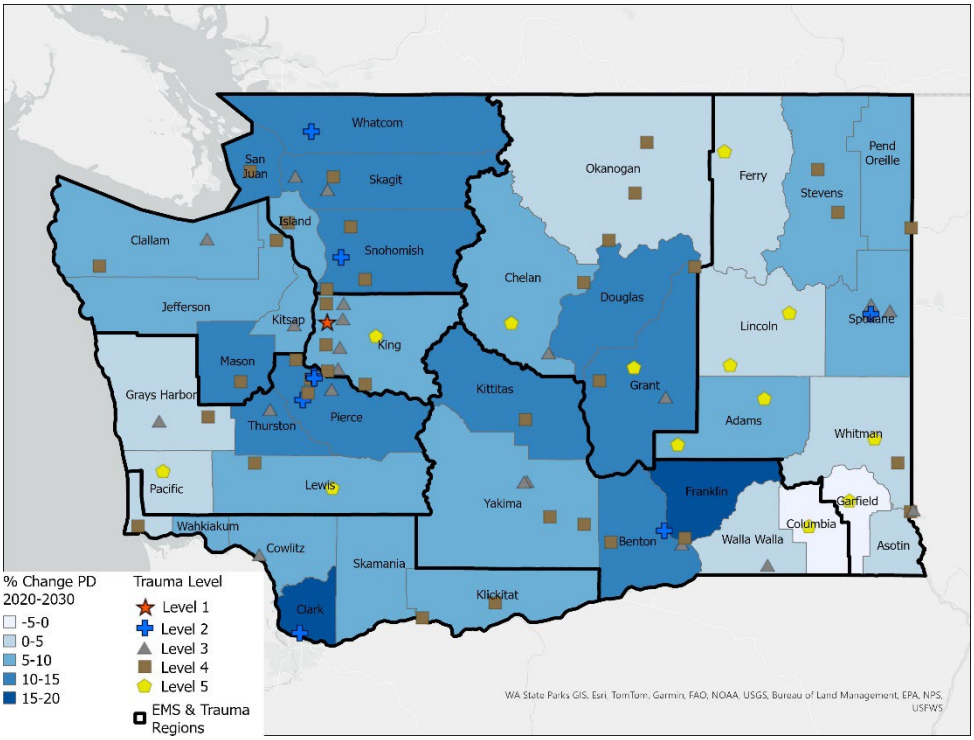


Figure 3 WA Percent change in population by county and trauma center locations 2020-2030[1,2]

While population has been rising in Washington, so have trauma incidents. In 2019 trauma incidents in Washington were six times higher than in 1995 when the trauma registry system began collecting information on trauma cases from designated trauma centers. (Figure 4) Figures 5 and 6 show the geographical distribution of trauma incidents in 2019 for all traumas and severe traumas relative to Washington trauma centers. From 1999 to 2020, WA has had a relatively consistent number of designated trauma centers at each level, with an increase in 5 level III centers and 3 level IV centers over two decades. Washington has had one level I facility since the inception of the trauma system in 1992. (Figure 7) Levels II, III and IV trauma centers have seen the greatest increase in patient volume in recent

years, as both the initial and final facility where care was received. More patients receive their initial care at a level III trauma center than at any other level, and more patients receive their final care at level II and III centers than any other level. (Figure 8 and 9)

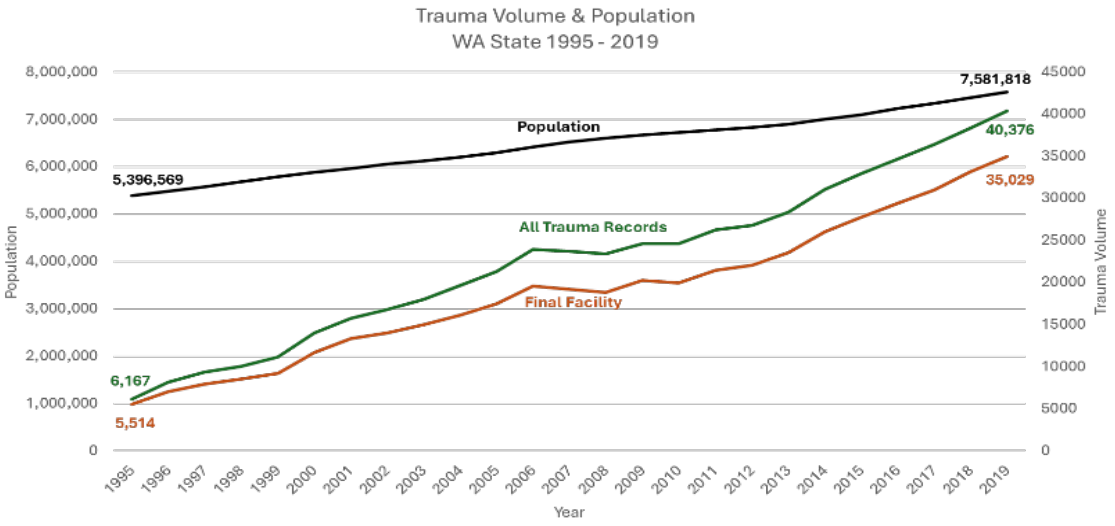


Figure 4 Trauma volume and population change 1995 – 2019[1,2]

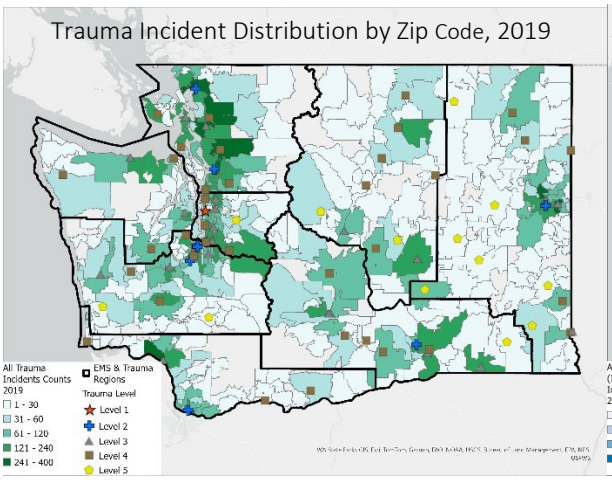


Figure 5 Map of Trauma Distribution by Zip Code, 2019[2,3]

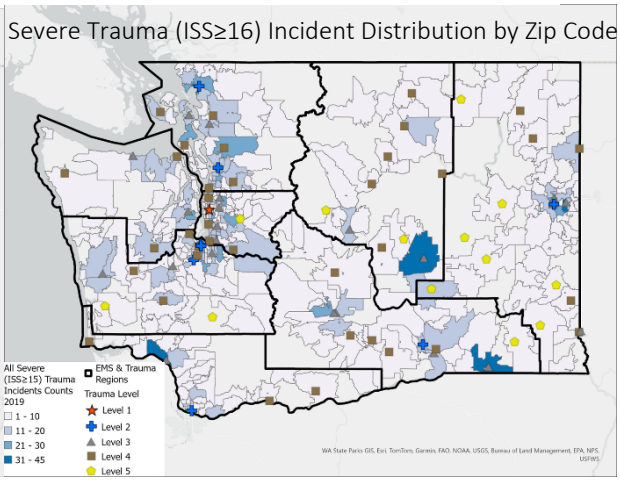


Figure 6 Map of Severe Trauma Distribution by Zip Code, 2019[2,3]

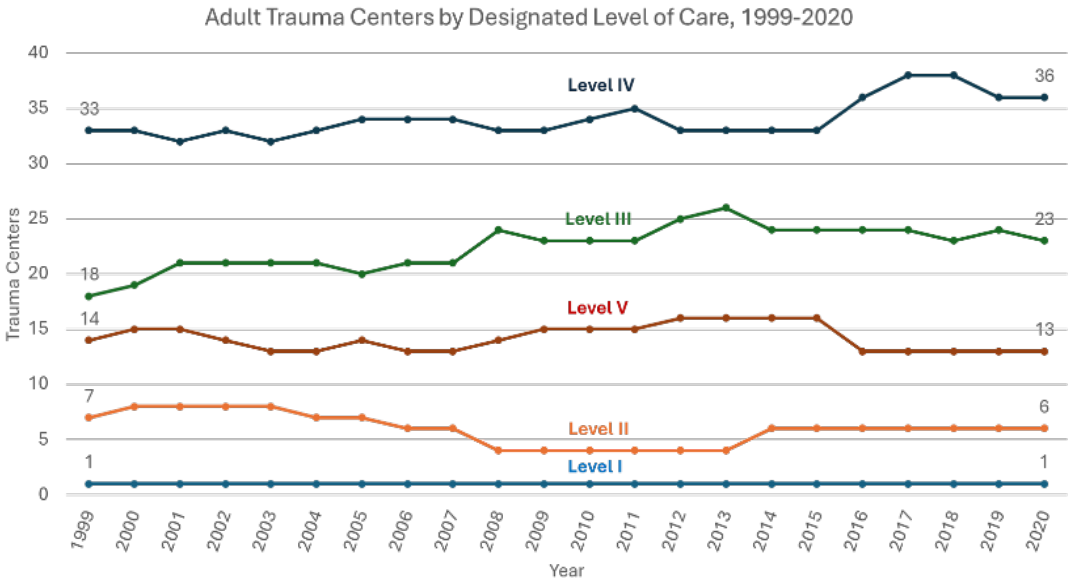


Figure 7 Adult Trauma Center Designated Level of Care, 1999-2020[2]

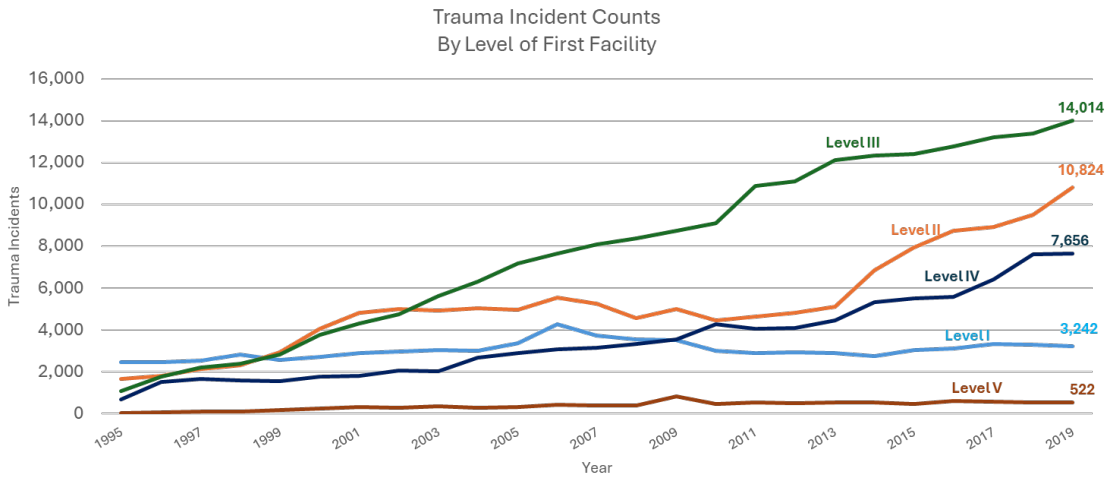


Figure 8 Trauma Incident Counts by Level of First Facility, 1995-2019[2]

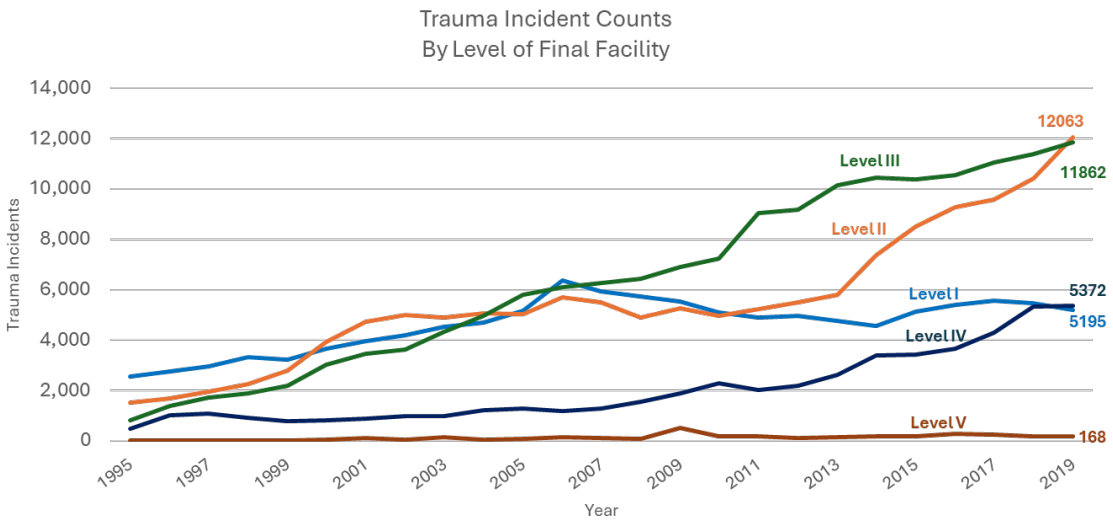


Figure 9 Trauma Incident Counts by Level of Final Facility, 1995-2019[2]

All EMS and Trauma Care regions in Washington have experienced population growth over the past 14 years and are projected to continue to see growth through 2030. (Figures 10 and 11). This period has also seen an increase in trauma volume in each of the regions, with the North, East, West and Central regions experiencing the most rapid growth in trauma volume. (Figure 12). In all but two regions, Southwest and North Central, the increase in trauma volume outpaces the population growth. In the North and East regions, this difference in growth is most pronounced. In the North region, the trauma incident rate increased by 132% between 2010 and 2019. During this same period the population in the North region increased by only 13%. (Figure 12)

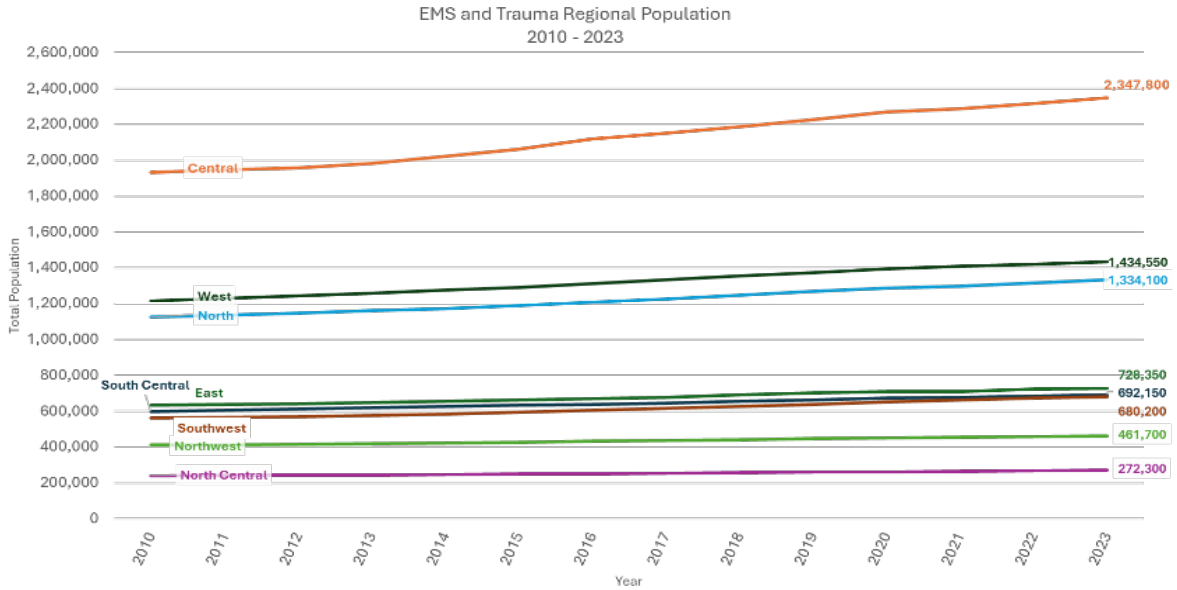


Figure 10 Population of EMS and Trauma Regions[1]

Projected Percent Change in Population by EMS and Trauma Region

Region	Projected Change 2020-2030
Central	+22%
East	+15%
North	+19%
North Central	+13%
Northwest	+12%
South Central	+15%
Southwest	+21%
West	+18%

Figure 11 Projected regional change in population[1]

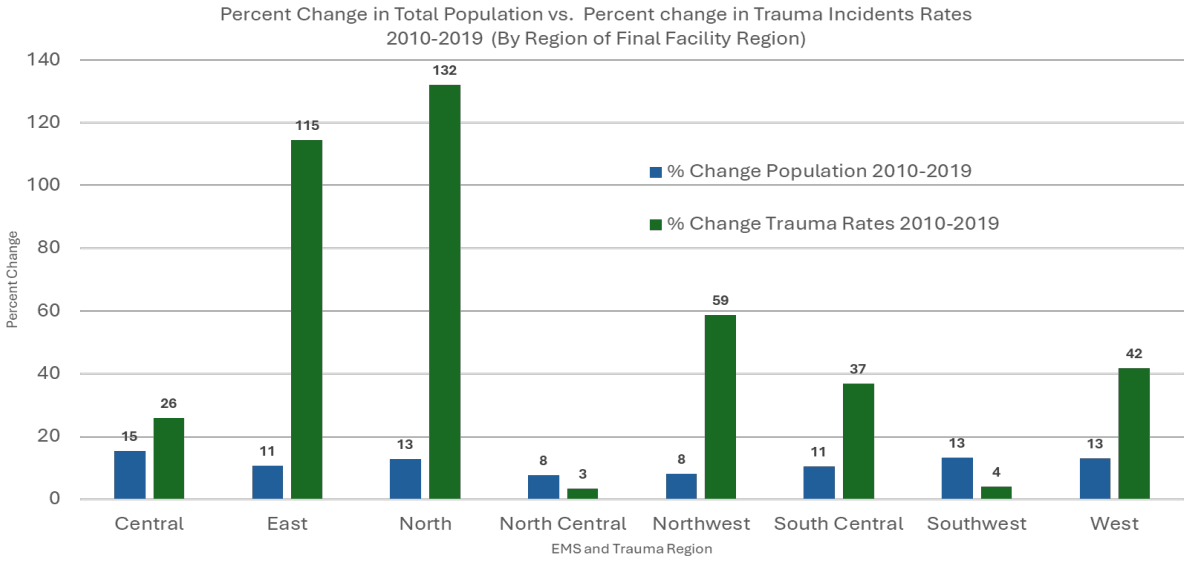


Figure 12 Past regional change in population and trauma incidents[1,2]

Rurality and Age

The EMS and Trauma Care System faces unique challenges depending on where an incident occurs. In urban areas for instance, higher populations equate to higher total injuries requiring EMS response and potential trauma activation. In rural areas, longer distances to the scene and to the hospital may impact time to care. As these factors are considered, it is important to understand the rurality of an area in order to assess the particular trauma system resources that may be needed. Statwide, from 2010 to 2023, urban and suburban areas have had the fastest growing populations at 17% and 16% respectively, while small and large rural towns have also continued to grow at 12% and 9% respectively. (Figure 13)

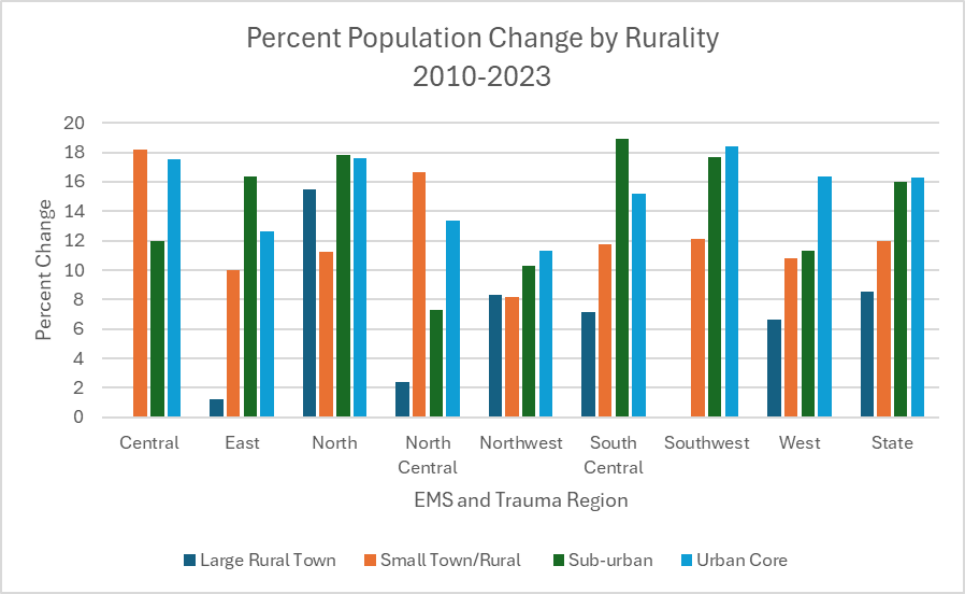


Figure 13 Rurality Population Percent Change, State & Regions, 2010-2023[1]

As populations continue to grow, it is projected that, although 15 to 64-year-olds account for most of the population statewide and in most regions, the population of 65 and older adults will grow most rapidly with a projected 30% increase statewide between 2020 and 2030. (Figures 14 & 15) This change may mean increases in geriatric trauma patients.

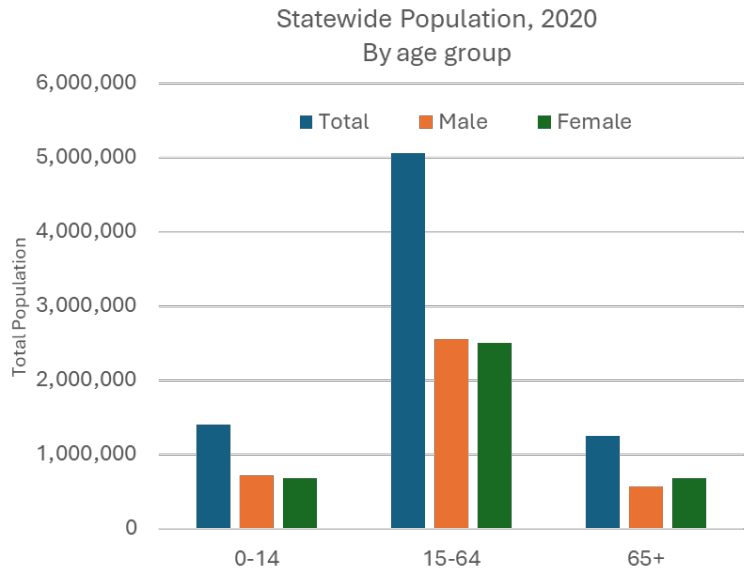


Figure 14 State population by age group[1]

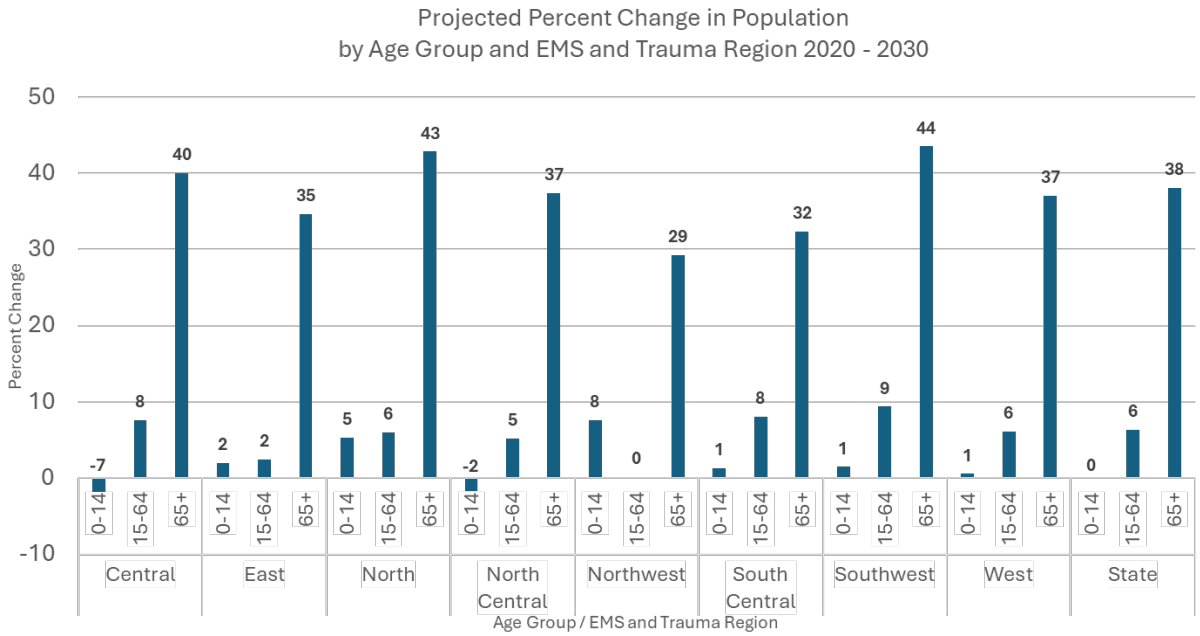


Figure 15 State and regional projected population growth 2020-2030[1]

Injury

Washington has already begun to see an impact of its growing older adult population on the type of common injuries seen in the trauma system. Falls, common among older adults, have been the leading primary mechanism of injury among trauma patients since 1996, when it outpaced motor vehicle traffic. (Figure 16) It has continued to increase since that time. From 2015 to 2019 the geriatric population of Washington has increased 19% (figure 17) while the geriatric trauma patient volume has increased 62%. (figure 18) Over the same period the rate of falls in the trauma system has increased by 38% (figure 16)

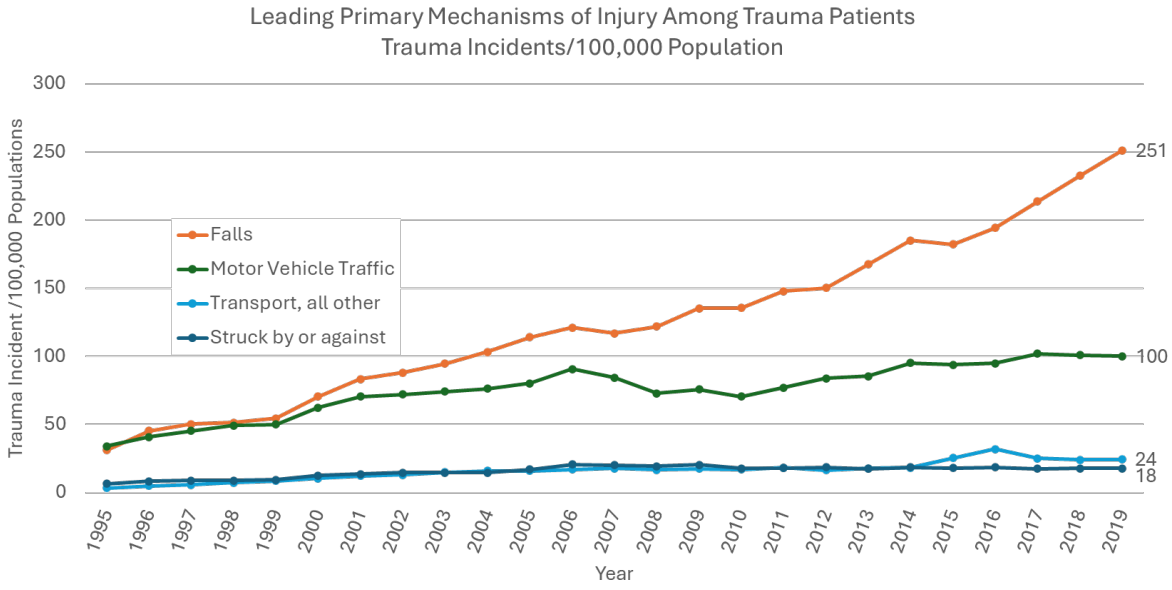


Figure 16 Primary Mechanisms of Injury[2]

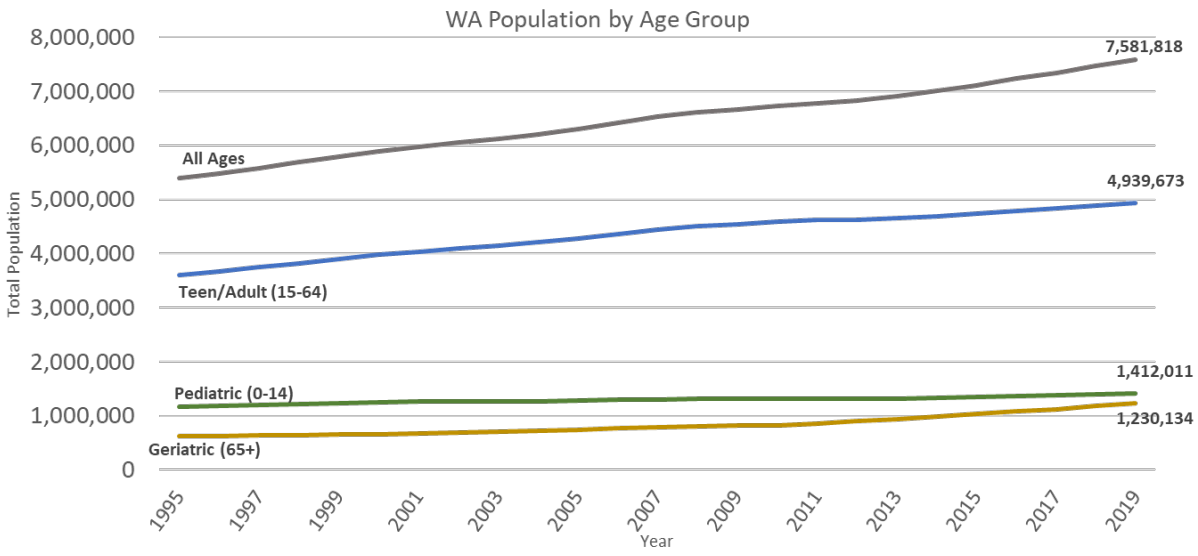


Figure 17 WA Population by Age Group, 1995-2019[1]

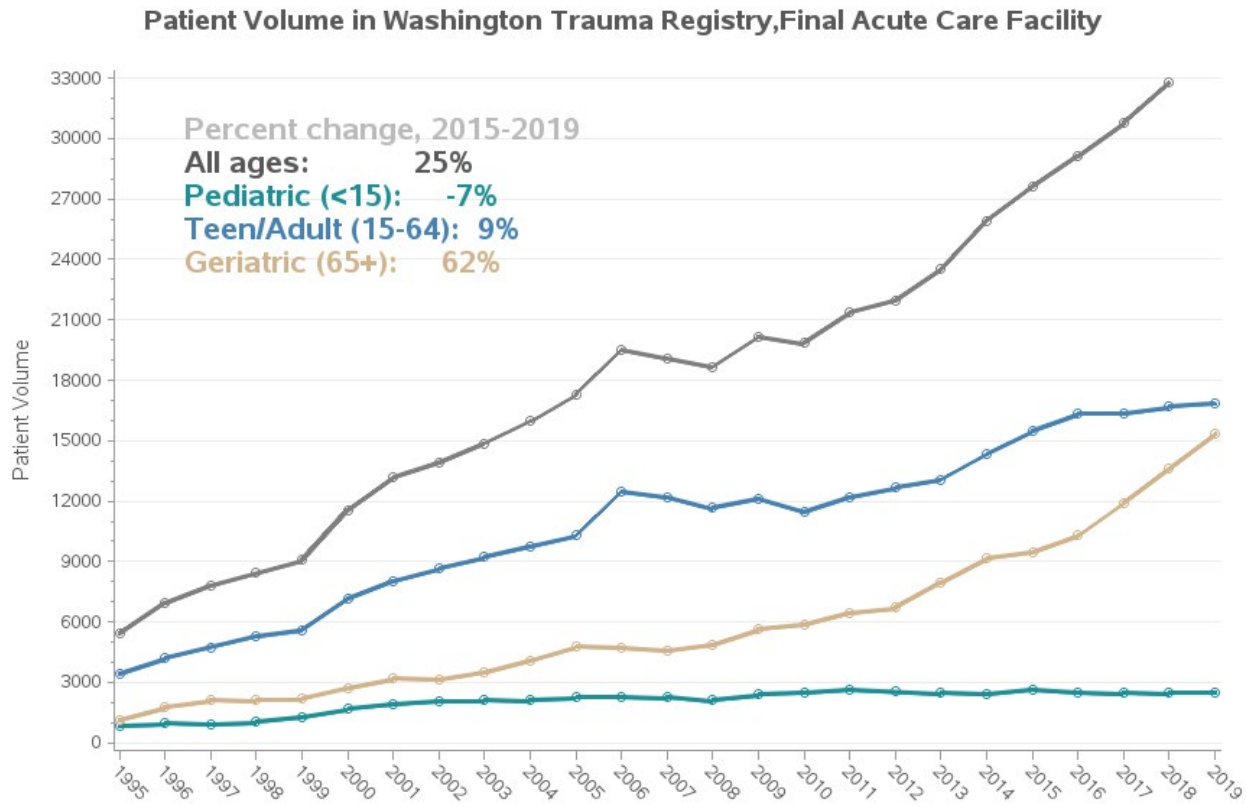


Figure 18 Trauma volume by age group[2]

Access to Trauma Services

Summary: Much of the state's population (99%) is within an hour from some level of trauma care (Level I thru V). Though fewer (84%) have access within an hour from a level I or II facility.

35% of severe trauma incidents, which often require a higher level of care, occurred further than 30 minutes from a level I or II trauma facility.

While most patients do not end up being transferred to a higher level of care, patient transfers out of the EMS and Trauma Region are most frequent among level V facilities while most patients transferred in for care from another region are going to the Level I trauma center.

Key Question: How accessible is trauma care in WA?

Distance to care: How much of the state population is within an accessible distance from trauma services?

In any needs assessment process, how accessible trauma care is to the affected population is critically important. Considering variation in accessibility based on different geographical locations within the state, geospatial analysis was used to determine the proportion of the state population and trauma incidents within a 60-, 45-, and 30-minute drive to trauma care. These times were selected to represent the potential to access care within the "Golden Hour", a measure of ideal time from injury to care at a trauma center. While a 60-minute drive time offers a baseline perspective of distance from care, the shorter time windows of 45- and 30-minutes help account for additional time that may be needed for EMS services to arrive at the scene following an injury. The 30-minute benchmark also serves as a useful measure of the potential to meet state trauma triage guidelines, which include transport of high risk patients to a level I or II trauma service within 30 minutes.

In 2019, most of the state population (99%) resided within an hour of some level of trauma care (Level I – V), while slightly lower proportions of the population (84%) were within an hour drive to higher levels of care (Levels I and II). These higher-level centers are important in providing care for higher severity injuries (Injury Severity Score ≥16). Among those severe injuries likely to result in the need for a level I or II trauma center, 85% occurred within an hour of such a facility, while only 65% occurred within 30 minutes from a Level I or II center. (figures 19-22)

Drive Time to a Trauma Center, 2019

Level I or II Trauma Center	**< 60 Minutes**	**< 45 Minutes**	**< 30 Minutes**
Population	84%	78%	66%
All Trauma Incidents	88%	82%	71%
Severe Trauma Incidents (≥16)	85%	77%	65%
Level I, II or III Trauma Center			
Population	96%	93%	85%
All Trauma Incidents	97%	94%	88%
Severe Trauma Incidents (≥16)	96%	93%	85%
Any Trauma Center (Levels I thru V)			
Population	99%	97%	93%
All Trauma Incidents	99%	98%	94%
Severe Trauma Incidents (≥16)	99%	98%	94%

Figure 20 30/45/60 min drive access to trauma centers[2,3]

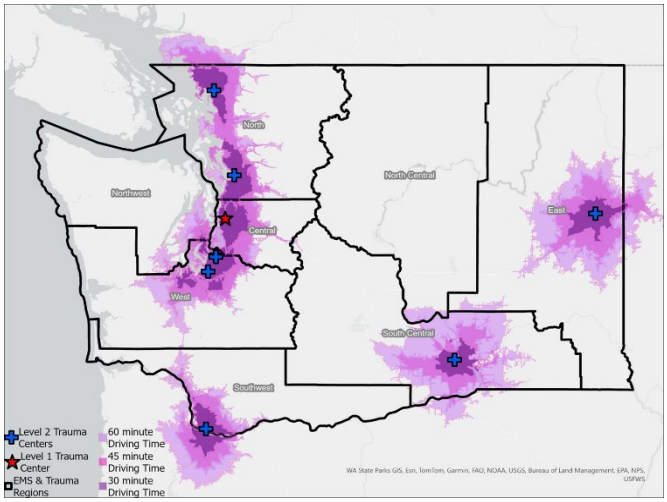


Figure 19 30/45/60 min drive time to Level I or II Trauma Center[2,3]

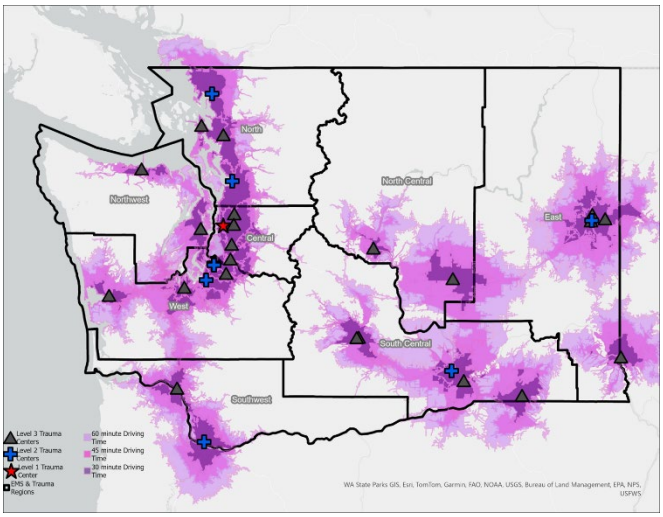


Figure 21 30/45/60 min drive time to Level I-III Trauma Center[2,3]

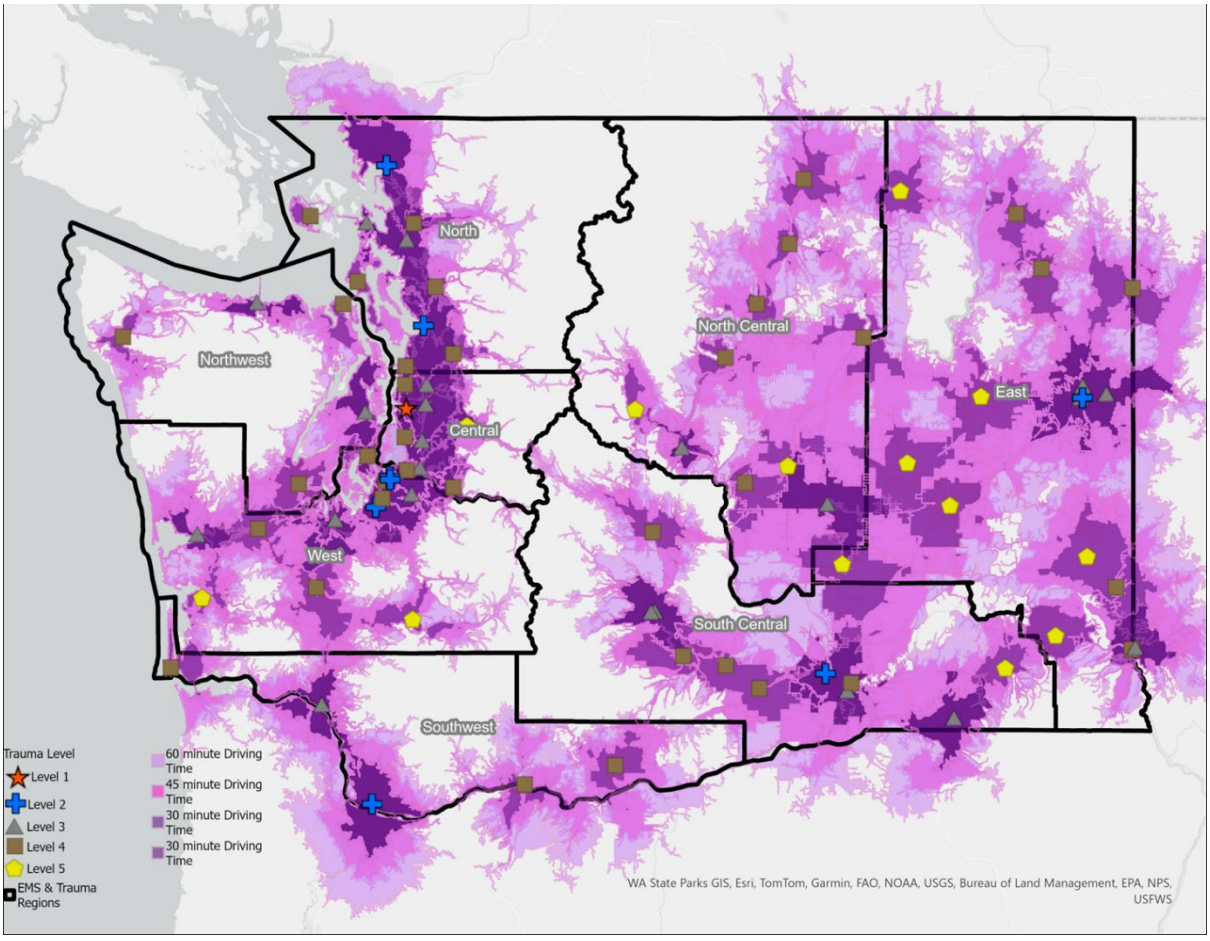


Figure 22 30/45/60 min drive time to any trauma center[2,3]

When looking at regional level, the access disparities become more apparent. Although population access to any trauma care center is similar across all regions, access to higher levels of care is much more restricted in regions like North Central and Northwest compared to other regions. (Figures 23) A similar pattern is seen when looking at trauma incident locations. (Figures 24 and 25)

Access disparities may be partially explained by the distribution of trauma centers with varying levels of care across the regions of the state. (Figure 26)

Population within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
Central	≤30 min%	85%	98%	99%
	≤45 min%	99%	99%	99%
	≤60 min%	100%	100%	100%
East	≤30 min%	67%	75%	91%
	≤45 min%	74%	85%	97%
	≤60 min%	78%	92%	99%
North	≤30 min%	76%	86%	93%
	≤45 min%	88%	94%	97%
	≤60 min%	92%	96%	98%
North Central	≤30 min%	0%	55%	84%
	≤45 min%	0%	68%	92%
	≤60 min%	3%	76%	98%
Northwest	≤30 min%	4%	60%	76%
	≤45 min%	29%	79%	90%
	≤60 min%	59%	90%	97%
South Central	≤30 min%	38%	78%	96%
	≤45 min%	46%	92%	98%
	≤60 min%	53%	98%	99%
Southwest	≤30 min%	70%	85%	89%
	≤45 min%	81%	91%	97%
	≤60 min%	90%	93%	99%
West	≤30 min%	70%	84%	92%
	≤45 min%	86%	95%	98%
	≤60 min%	90%	97%	99%

Figure 23 Regional population within driving distances to trauma centers[2,3]

Percent of trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
Central	≤30 min%	91%	98%	99%
	≤45 min%	98%	99%	100%
	≤60 min%	99%	99%	100%
East	≤30 min%	84%	88%	95%
	≤45 min%	89%	94%	99%
	≤60 min%	93%	97%	100%
North	≤30 min%	70%	87%	93%
	≤45 min%	86%	93%	97%
	≤60 min%	92%	95%	98%
North Central	≤30 min%	0%	54%	83%
	≤45 min%	1%	70%	91%
	≤60 min%	6%	80%	97%
Northwest	≤30 min%	7%	75%	84%
	≤45 min%	38%	90%	95%
	≤60 min%	61%	95%	99%
South Central	≤30 min%	33%	84%	95%
	≤45 min%	38%	93%	98%
	≤60 min%	42%	98%	99%
Southwest	≤30 min%	74%	86%	91%
	≤45 min%	85%	92%	98%
	≤60 min%	94%	95%	100%
West	≤30 min%	72%	84%	95%
	≤45 min%	85%	96%	99%
	≤60 min%	92%	98%	100%

Figure 24 Regional trauma incidents within driving distances to trauma centers[2,3]

Percent of Severe Trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
Central	≤30 min%	90%	98%	99%
	≤45 min%	97%	98%	99%
	≤60 min%	99%	99%	100%
East	≤30 min%	77%	81%	94%
	≤45 min%	85%	92%	100%
	≤60 min%	89%	96%	100%
North	≤30 min%	68%	85%	95%
	≤45 min%	83%	90%	98%
	≤60 min%	90%	95%	99%
North Central	≤30 min%	0%	67%	87%
	≤45 min%	0%	79%	90%
	≤60 min%	3%	87%	100%

Northwest	≤30 min%	8%	66%	87%
	≤45 min%	38%	80%	91%
	≤60 min%	70%	91%	99%
South Central	≤30 min%	18%	79%	95%
	≤45 min%	22%	94%	99%
	≤60 min%	32%	97%	99%
Southwest	≤30 min%	67%	82%	88%
	≤45 min%	84%	91%	98%
	≤60 min%	93%	94%	100%
West	≤30 min%	61%	78%	93%
	≤45 min%	79%	94%	99%
	≤60 min%	89%	99%	100%

Figure 25 Regional severe trauma incidents within driving distances to trauma centers[2,3]

Where do patients go for trauma care?

Figure 27 shows the proportion of trauma patients who were transferred to a higher level of care at some point during their care journey. Most patients in the trauma system remain at their initial facility, however, the number of patients transferred out of that initial facility is higher for lower-level facilities (Levels III - V). While these statewide transfer patterns for 2019 are consistent with what is to be expected, with patients increasingly transferred to higher levels of care when they first arrive at lower levels, this measure represents an important tool for monitoring the volume of patients needing higher levels of care and requiring transfer. For the purposes of identifying additional resources needs in a region, for instance, a high percentage of patients being transferred to a higher level of care could indicate a need for resources or redesignation in an area. One potential benefit of redesignation of a facility with a high number of transfers is shorter times to definitive care for higher severity patients.

Figure 28 shows the proportion of trauma patients based on their transfer status between different levels of care. We can see that for levels II through IV most patients were admitted with no transfers. Most patients transferred out were those admitted to a level V, while the Level I facility mostly received patients transferred in from other levels of care. Level V facilities also showed the largest proportion of patients transferred out of region compared to other levels of care. Transfers out of the region are a helpful indicator of possible gaps in resources. Though often necessary to ensure patients receive the appropriate care for their injury, transfers out of region may result in patient and family burden due to increased travel costs for visitation. Out of region transfers may also burden EMS capacity as EMS units may be required to transport the patient long distances, preventing them from responding to other calls during that time. Interfacility transport methods and family considerations vary across the state.

Trauma Patients Initial and Highest Designated Level of Care (%), State, 2019

		Highest Level of Care				
		Level I	**Level II**	**Level III**	**Level IV**	**Level V**
Initial Level of Care	**Level I**	100%	-	-	-	-
	Level II	3%	98%	-	-	-
	Level III	6%	5%	89%	-	-
	Level IV	6%	10%	1%	83%	-
	Level V	9%	21%	7%	-	63%

Figure 26 Trauma Patients Initial & Highest Designated Level of Care (%), State, 2019[2]

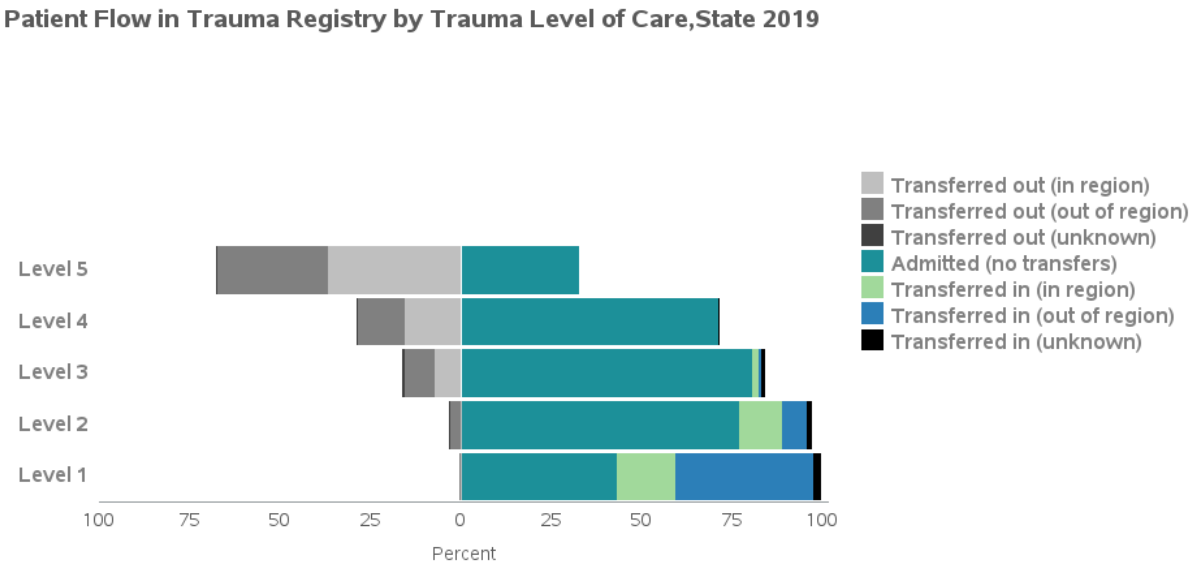


Figure 27 Patient Flow in Trauma Registry by Trauma Level of Care, State 2019[2]

How are patients moved?

Air Medical Transport

Air medical transport includes fixed wing (airplanes) and rotor wing (helicopters) aircraft. They are utilized in situations where ground transportation (ambulances) is less effective, such as critical trauma patients where time is an important factor in improving outcome, or when carrying patients between states.

Air medical transport provides more speed and maneuverability over ground transport as ground transport is limited by factors such as availability of roads, road conditions and traffic. However, there are also disadvantages to air transport including increased cost, susceptibility to weather conditions, weight limitation, and safety of patients and staff.

While air transport can travel much faster than ground transportation, there is a loss of time for setting up a landing zone (or transporting to an airport) and evaluation by the flight crew.

In Washington, air medical transport of all trauma patients from the scene account for a between three and five percent of all transports annually. Severely injured patients are more frequently transported by air, 10-15% annually. (Figures 29 and 30)

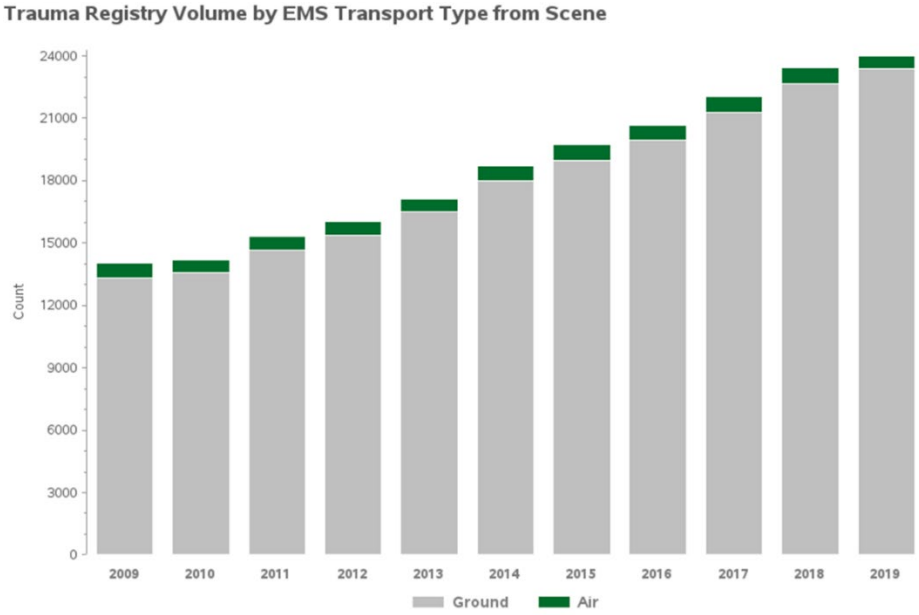


Figure 28 Trauma Registry Volume By EMS Transport Type from Scene

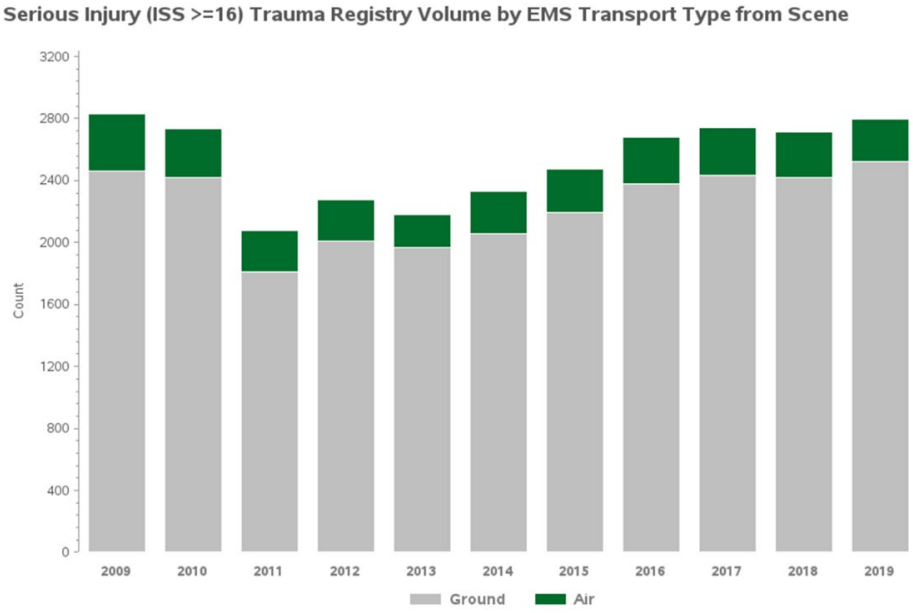


Figure 29 Serious Injury (ISS>=16) Trauma Registry Volume by EMS Transport Type from Scene

In Washington, most patients transported via air are taken to the Central region, where the state's sole level I facility is located. However, there is variation depending on where a patient was injured. Most air transports for injuries occurring in the north, west and northwest regions were taken to central region. In the remaining five regions, most air transports are taken to a facility within the region of injury. Air transport for injuries from out of state or undocumented locations were primarily taken to the south

central and east regions. The northwest region had the largest number of air transports for trauma patients, the southwest region had the smallest (Figure 31). In contrast, ground transport most often remains in the region of injury.

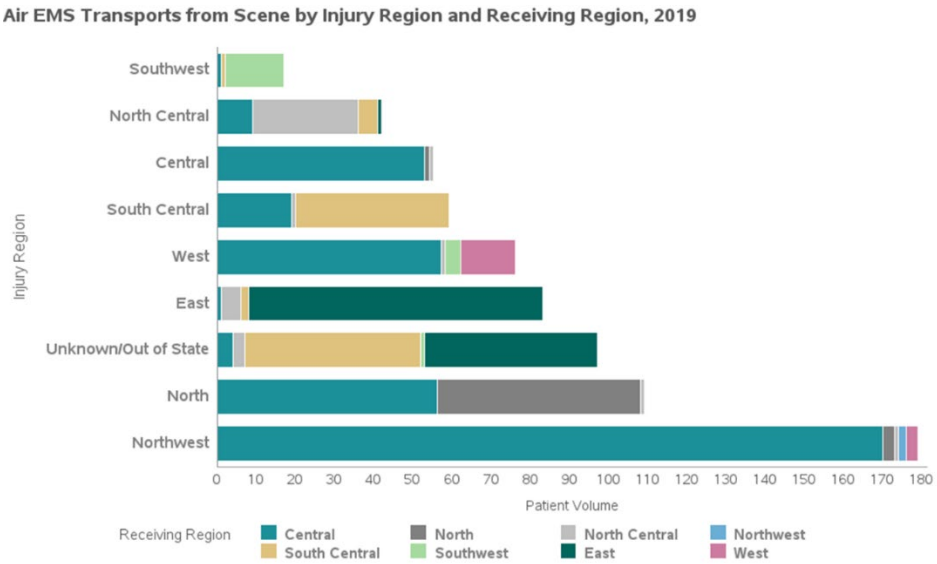


Figure 30 Air EMS Transports from Scene by Injury Region and Receiving Region, 2019

Air Medical Transfers

In 2019, interfacility air transfers were primarily taken to the central region except for injuries occurring in the east and southwest regions where transfers remained within the same region of injury. The southcentral region had the largest number of interfacility air transfers for trauma patients, the central region had the smallest. (Figure 32)

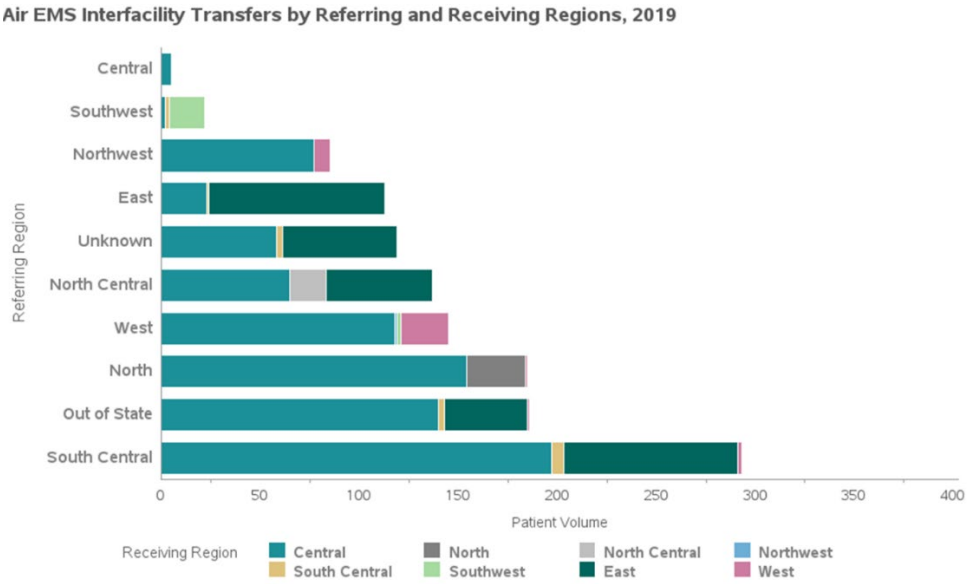


Figure 31 Air EMS Interfacility Transfers by Referring and Receiving Regions, 2019

Interfacility ground transfers showed a similar pattern to air transfers with a notably higher proportion of transfers to the west region.

Air Medical Transport Times

The average transport time from scene departure to hospital arrival was longer for air compared to ground transport. (Figure 33). This could be explained at least partly by time lost setting up a landing zone (or transporting to an airport), evaluation by the flight crew, and longer distances travelled by air.

The average time between facilities for interfacility transfers was also longer for air compared to ground transport, although the difference was smaller than seen in from scene transports and may largely be explained by the use of air transport in transfers over longer distances.

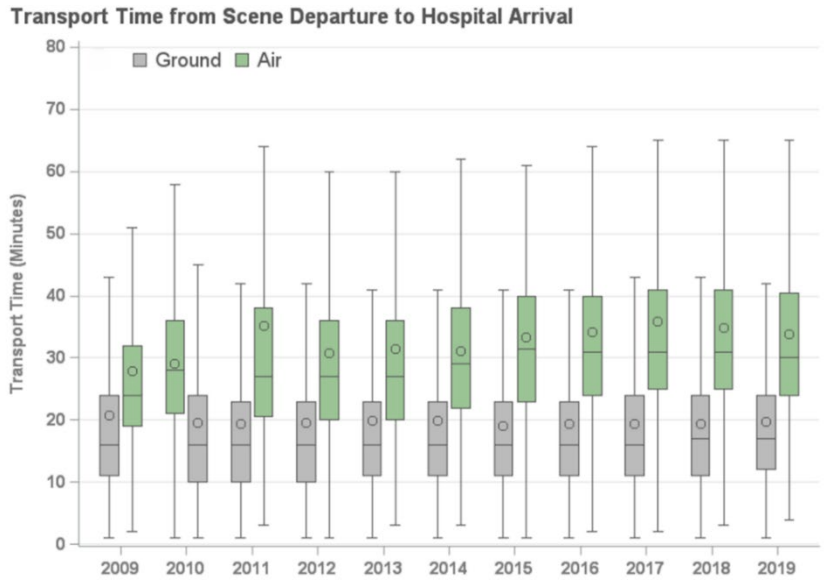
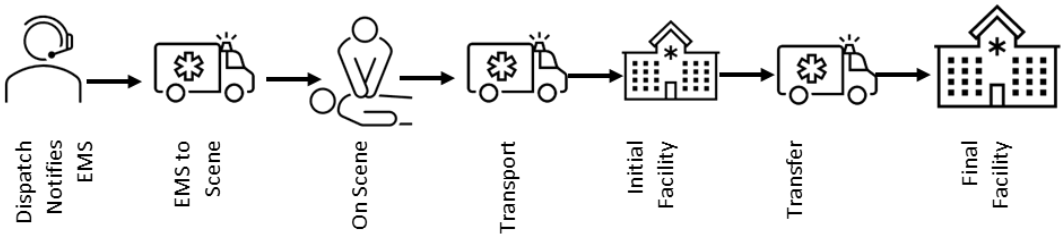


Figure 32 Transport Time from Scene Departure to Hospital Arrival

Time to Care

Summary: To assess the timeliness of appropriate trauma care, time to care can be broken into segments:



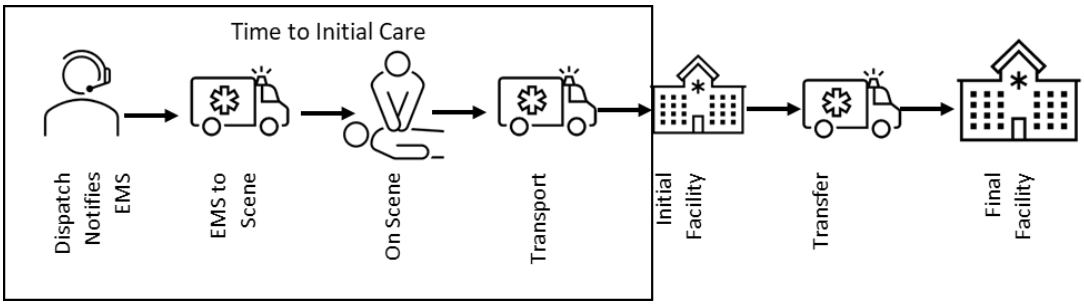
Time from EMS Notification to Scene Departure: In 2019, the average time from EMS being notified by dispatch to EMS departing the scene of the injury with the patient was 29.2 minutes.

Time from Scene Departure to arrival at initial facility: In 2019, the average time from EMS departing the scene with the patient to arriving at the initial facility was 33 minutes.

Combined, the average time from EMS notification of an incident to the patient arriving at the initial facility was 60.2 minutes. I 2019, 64 percent of patients arrived at the initial facility within 60 minutes of injury.

Time from EMS Notification to Definitive Care: In 2019, the average time from injury to definitive care at the final facility was 85.6 minutes. This average includes those who were transferred to a higher-level facility and those who remained at their initial facility. Time to definitive care is substantially longer for patients who are transferred, than for patients who remain at their initial facility and longer still for those transferred outside of the EMS and Trauma region.

Key Question: How long does it take to get appropriate trauma care?



The golden hour is a helpful benchmark to assess whether timely care is being achieved in a particular area. The “golden hour” is the first 60 minutes following severe injury which is considered a crucial period for determining the patient's outcome. During this period it is critical that severely injured patients reach care where emergency and resuscitative surgical teams are available. One way to assess whether this 60-minute window is likely to be achieved is to combine

the drive time or transport time to a facility with the time it takes EMS to respond to and depart from the scene of the injury.

For instance, if the average time for EMS to respond to and depart a scene is 30 minutes, the golden hour is likely to be achieved in a geographic area where a trauma facility is located within a 30-minute drive time. If the average time for EMS to respond to and depart a scene is 15 minutes, the golden hour is likely to be achieved in a geographic area where a trauma facility is located within a 45-minute drive-time. For this reason, this section first considers these two stages of the EMS response to trauma incidents: Time from EMS notification to scene departure and time from scene departure to arrival at the initial facility. From there the time at the initial facility and the transfer time between facilities are assessed to look more closely at the total time from injury to definitive care at the final trauma facility.

Stage 1: Dispatch to scene departure – How quickly can EMS provide care and leave the scene after being notified by dispatch?

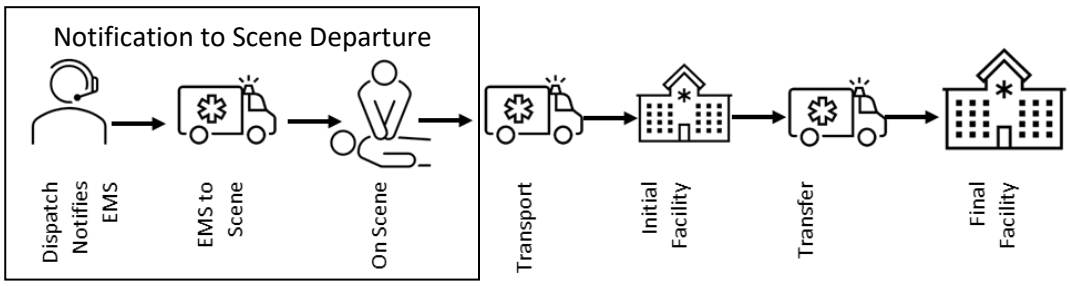


Figure 34 shows the average time from when the first EMS unit was notified by dispatch to when the unit left the scene of the incident, which includes the response and scene time portions of the initial EMS response. The data used here include linked trauma and EMS data, which may involve multiple EMS units responding to the same patient. The average time from the first unit notified to departure of ambulance was 29.2 minutes. With the average time as an example, the patient would need to be transported to a trauma facility within 30.8 minutes to receive care within 1-hour. However, this goal may be less feasible in certain counties, such as the six counties where the average unit notified to departure time exceeds 45 minutes. The average unit notified to departure time in these counties would leave less than 15 minutes for EMS to transport the patient to a trauma facility within a 60-minute time window. Across the state, about 35 percent of trauma incidents have a notification to scene departure time greater than 30 minutes, meaning they have less than 30 minutes to reach initial care within an hour of injury. (Figure 35)

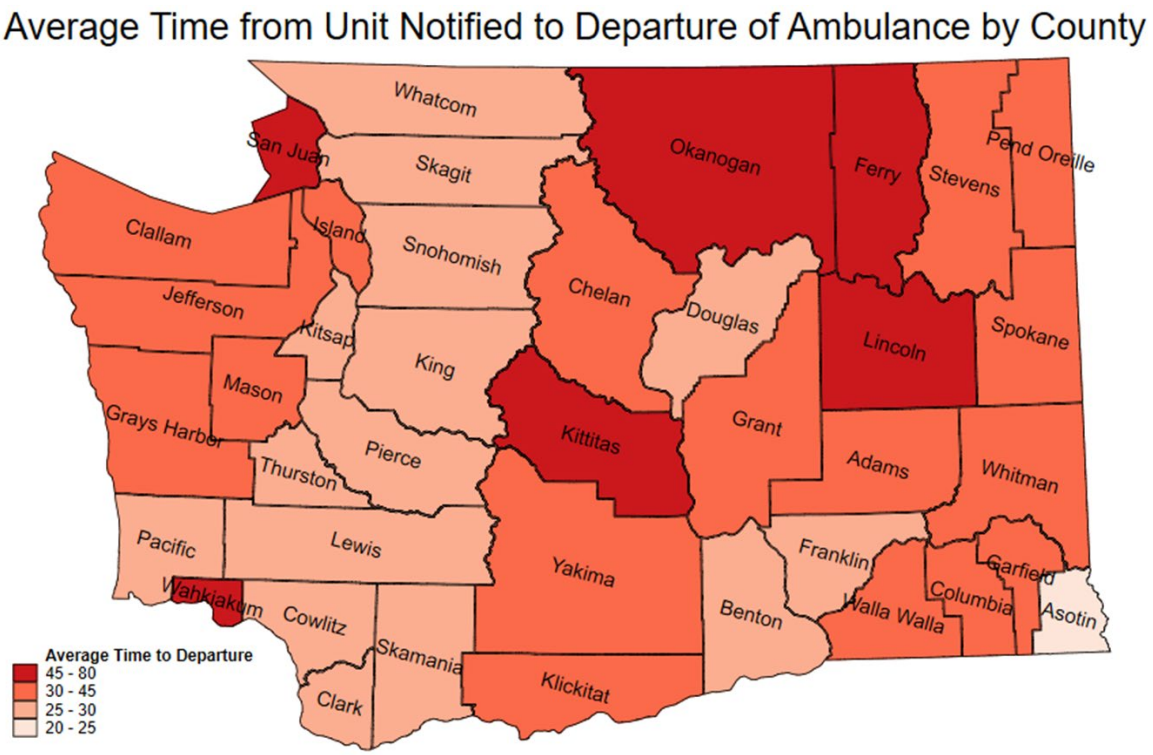


Figure 33 Average Time from EMS Unit Notification to Ambulance Scene Departure by County[2,3]

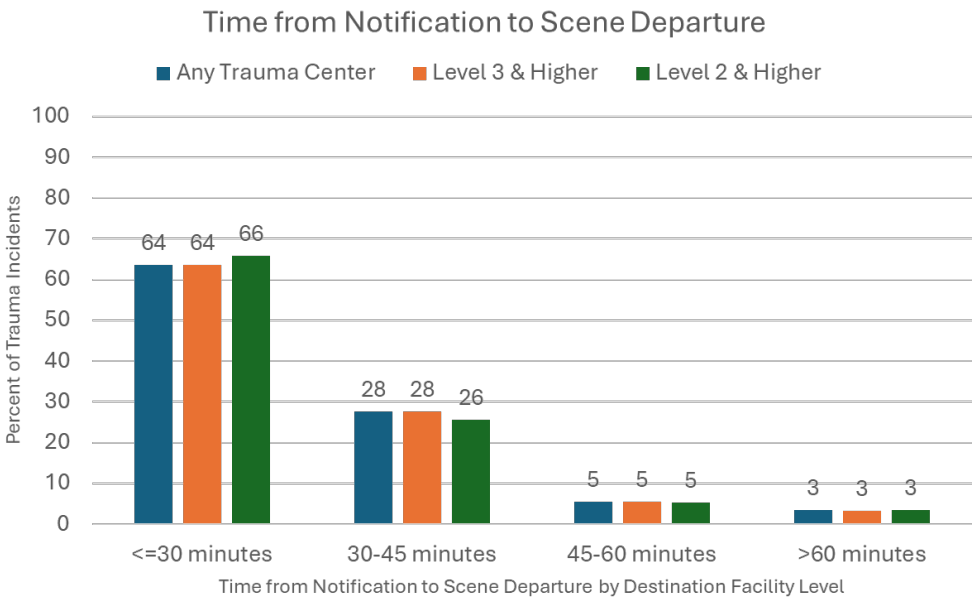
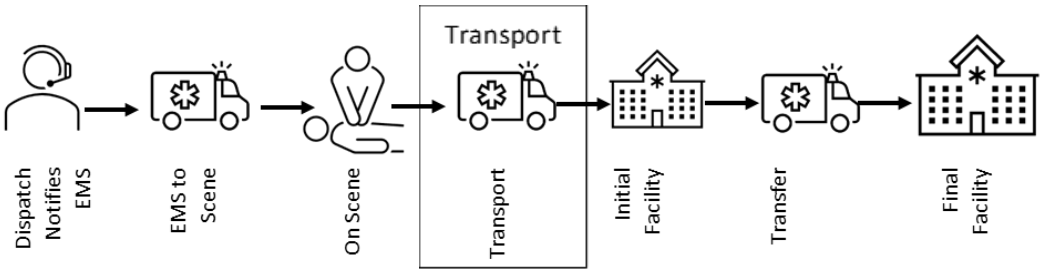


Figure 34 Time from EMS Unit Notification to Ambulance Scene Departure by Destination Facility Level[2,3]

Stage 2: Transport time – How quickly can the ambulance transport the patient from the scene to the hospital?



Next, we consider the transport portion of the EMS response. Figure 36 shows the average transport time to the first trauma facility by the county of the initial EMS response. The transport times here include potential transfers to air medical units if they occurred prior to the initial facility. Statewide, the average transport time to initial trauma facilities in 2019 was 33 minutes. Across the state, about 35% of trauma incidents had a transport time to the initial facility greater than 30 minutes. (Figure 37)

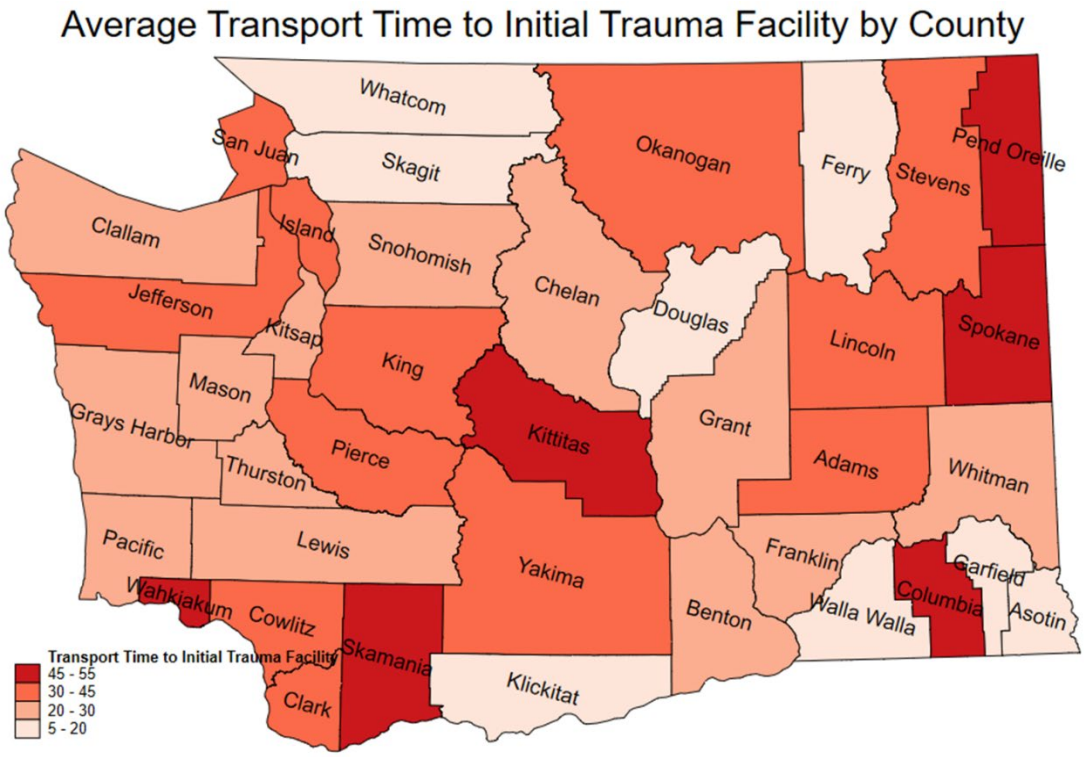


Figure 35 Average Transport Time to Initial Trauma Facility by County[2,3]

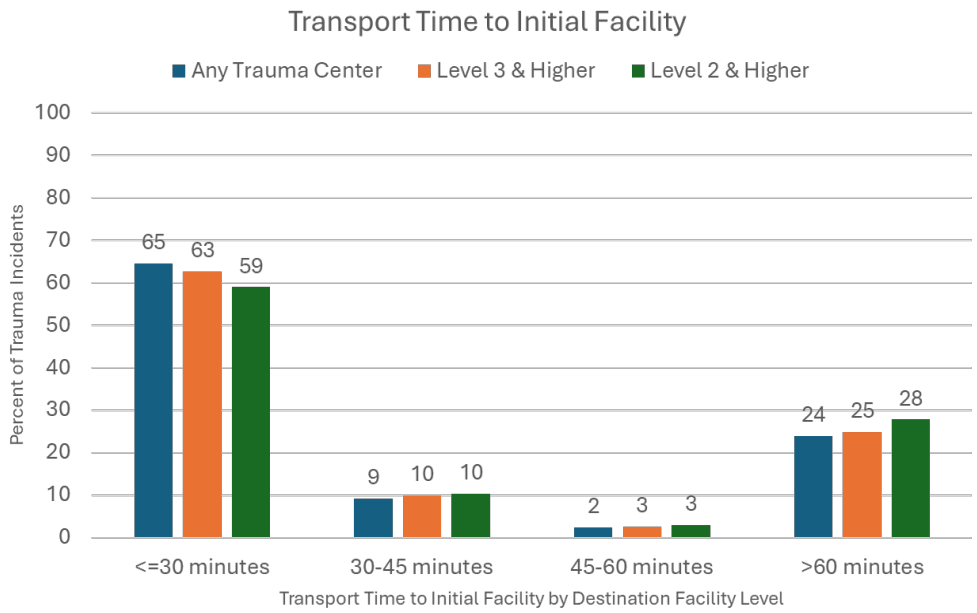
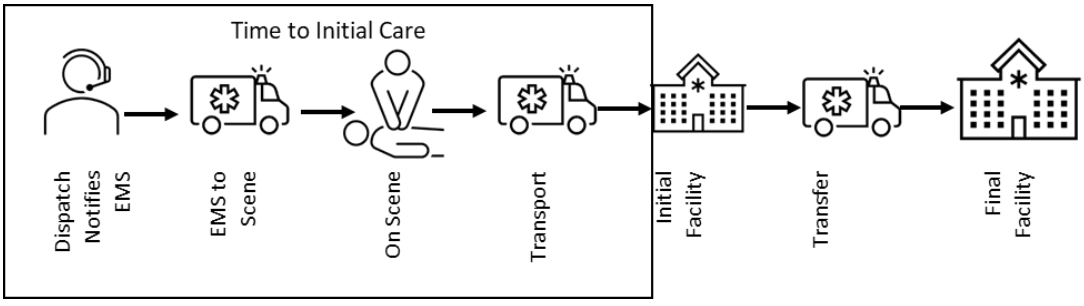


Figure 36 Transport Time to Initial Facility by Destination Facility Level[2,3]

EMS Facility Wait Times (aka "Wall Time")

In addition to response, scene, and transport times, the time needed to transfer care from EMS to the emergency department after arriving at the hospital, known as wall time, would help inform potential gaps in hospital capacity that may impact care times. While this information can be reported in EMS patient care records, the frequency of wall-time documentation varies greatly across EMS services. In 2024, only 10 counties reported EMS wall time data in more than 50 percent of EMS records. This completion rate was determined to be too low to report reliably. Inclusion of this indicator will be reconsidered in future updates to this assessment.

Putting it together: How quickly do patients arrive at their initial facility after injury?



Now that we have assessed both the time from dispatch to scene departure and the time from scene departure to hospital arrival, it is time to look at the whole picture: time from EMS notification to arrival at the first facility. This span of time is crucial to effective patient care.

Figure 38 shows the average time from when the first responding EMS unit was notified by dispatch until the patient arrived at the first trauma facility. The averages are mapped by the county of the initial EMS response.

In 2019, time to first trauma facility varied greatly by county. The average time to first trauma facility was 60.2 minutes. County averages vary from less than 45 minutes for selected counties and greater than 90 minutes for others. Notably, the counties where average time to first facility was greater than 90 minutes are in more rural areas and have either a level 4 trauma center or no trauma center at all. Still, rurality is not the only factor in time to first facility, as all five counties with an average time to first trauma facility of less than 45 minutes are counties that are designated as rural by the WA State Office of Financial Management.

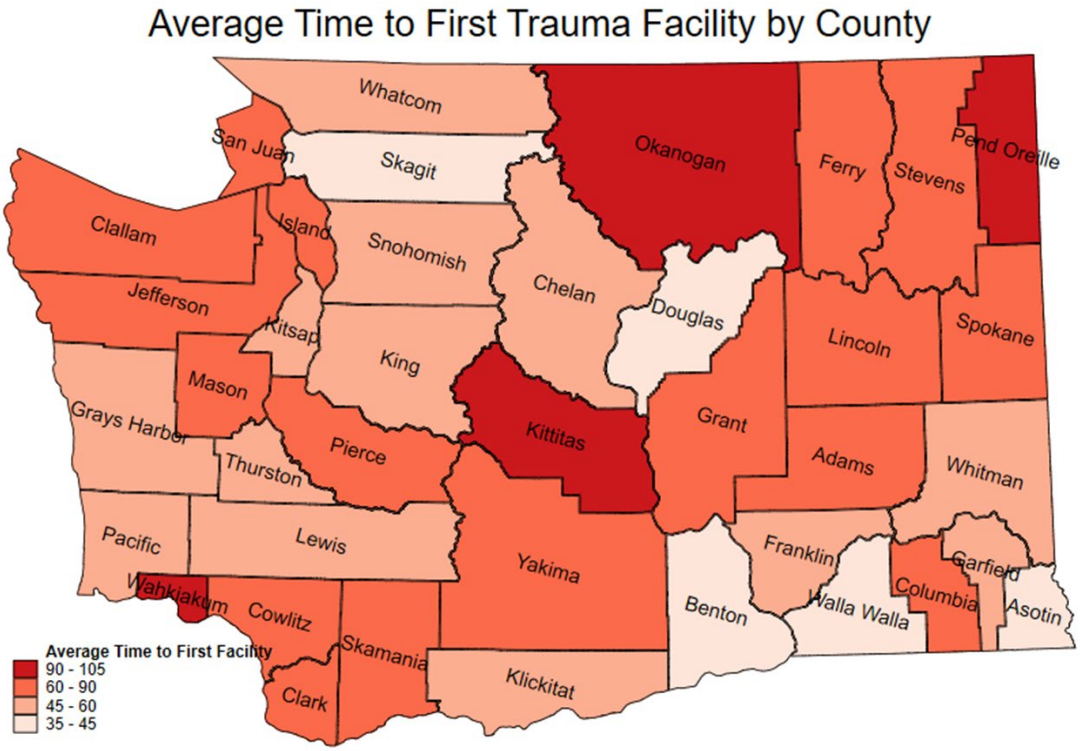


Figure 37 Average Time to First Trauma Facility by County[2,3]

Figure 39 shows the percentage of trauma incidents where the time to first facility was within each time grouping by the trauma center level to which the patient was first taken. In 2019, patients arrived at the first trauma center within 60 minutes from when dispatch notified the EMS unit in 64 percent of trauma incidents. This shows that 64 percent of trauma patients are making it to a trauma facility within 60-minutes. It took longer than 90 minutes for the patient to arrive at the first trauma center in 20 percent of incidents. When considering incidents where patients were initially transported to a level 2 trauma center or higher, 55 percent of patients made it to the trauma center within 60 minutes and 27 percent took longer than 90 minutes. The difference in time to first facility for all trauma levels versus level II centers and higher is likely related to greater availability of the level III centers and lower, as well as triage protocols that prioritize transports to lower trauma

levels if available. However, there was little difference in the time to first facility when comparing ISS of 15 or lower to ISS of 16 or higher.

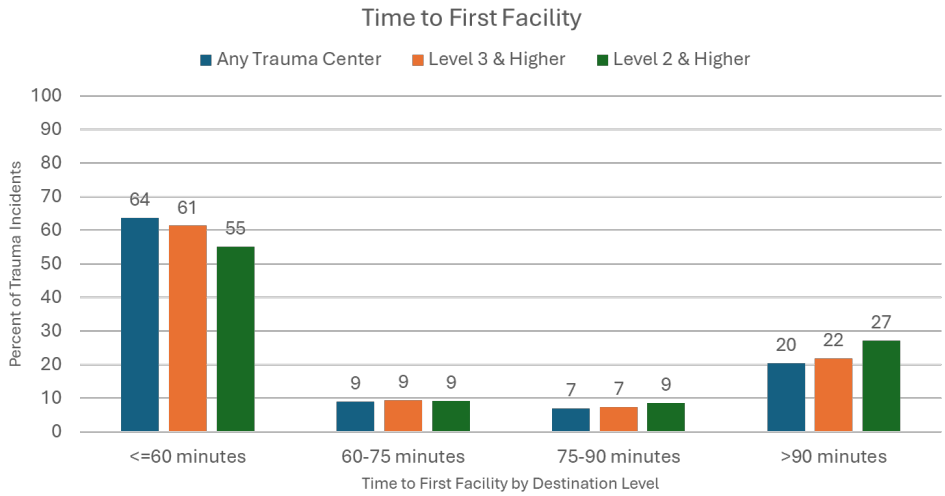
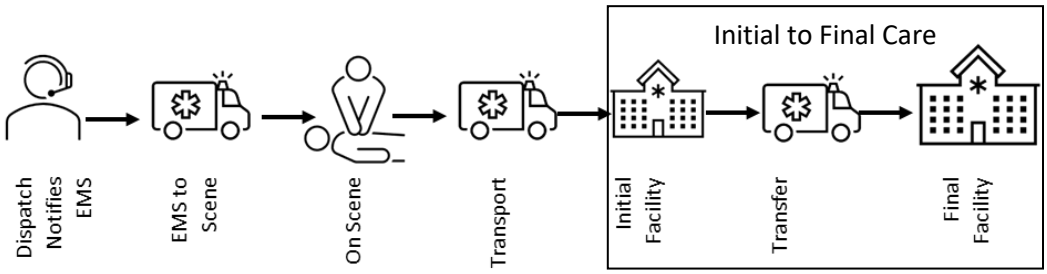


Figure 38 Time to First Facility by Destination Facility Level[2,3]

After Initial Care – What happens to patients after they arrive at the initial facility?



To ensure seriously injured patients are rapidly triaged, assessed, and transferred to higher levels of care, a consensus was developed between the EMS and Trauma Hospital Technical Advisory Committee (TAC), Outcomes TAC, and the Department to measure the emergency department (ED) length of stay and set a benchmark of three hours. This benchmark was also included in the 2019 version of the trauma service standards requiring facilities to measure ED length of stay (LOS) and set a three-hour benchmark for their individual facility.

Figure 40 shows the distribution of lengths of stay at a trauma facility from which the patient is transferred by ISS level. Patients with an ISS of 15 or lower had an average length of stay before transfer of 3.8 hours, while patients with an ISS of 16 or higher had an average length of stay of 4.1 hours. However, there was no statistically significant difference between the two groupings.

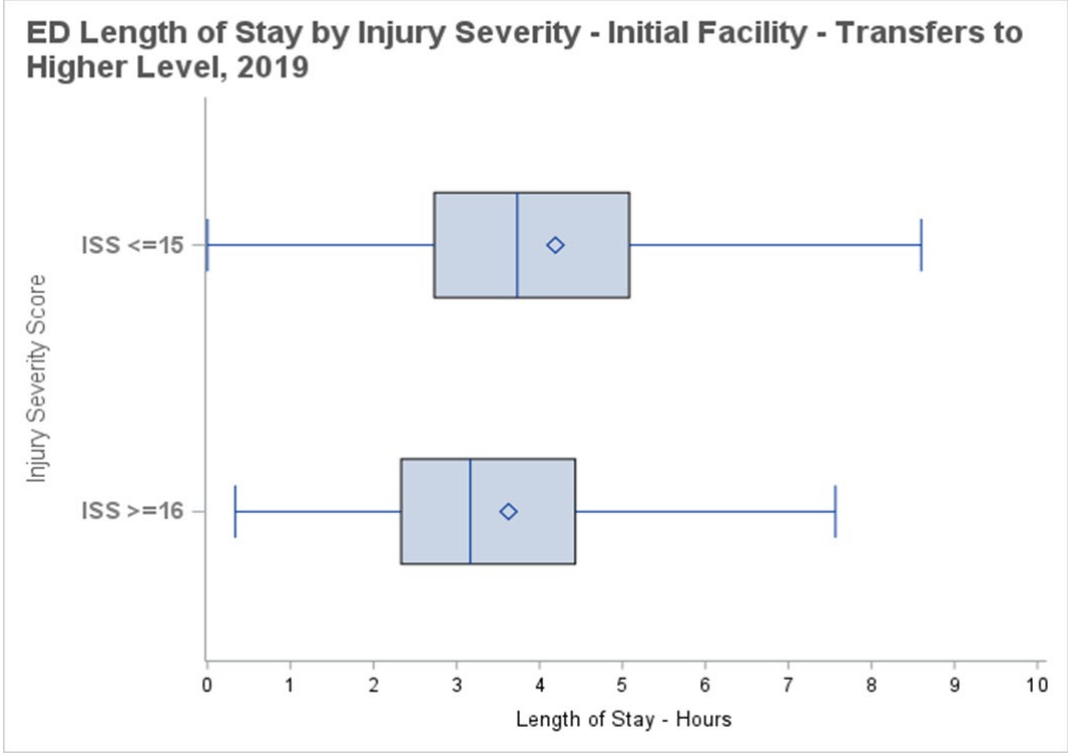


Figure 39 Emergency Department Length of Stay at Initial Facility, Patients Transferred to Higher Level of Care, by ISS[2]

Figure 41 shows the average length of stay at the initial facility compared across ISS level and the region of the initial trauma facility. Despite variation in the distributions of lengths of stay across counties, there was also no statistically significant difference between the ISS and region groupings.

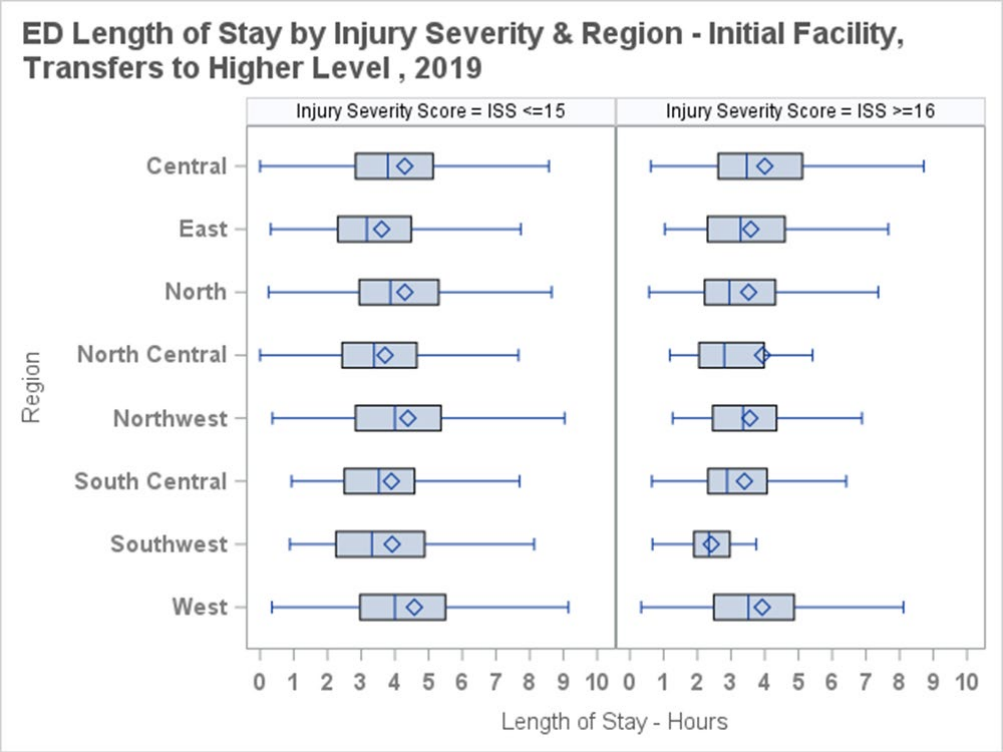


Figure 40 Regional Emergency Department Length of Stay at Initial Facility, Patients Transferred to Higher Level of Care, by ISS[2]

Figure 42 shows the time from the first EMS unit notified by dispatch until the time of arrival at the definitive trauma facility, or the highest level of care to which they are transferred. These times combine time to first trauma facility, the length of stay at the initial facility or facilities, and the EMS transports to their definitive trauma facility. In 2019, the statewide average time to definitive facility was 85.6 minutes. The counties with a time to definitive trauma facility of greater than 120 minutes were the largely those with only level 4 or 5 trauma centers or were geographically isolated from the nearest level 2. These averages include both patients who were transferred to a higher level of care and those who remained at their initial facility. Time to definitive care increases substantially when patients are transferred. (Figure 43)

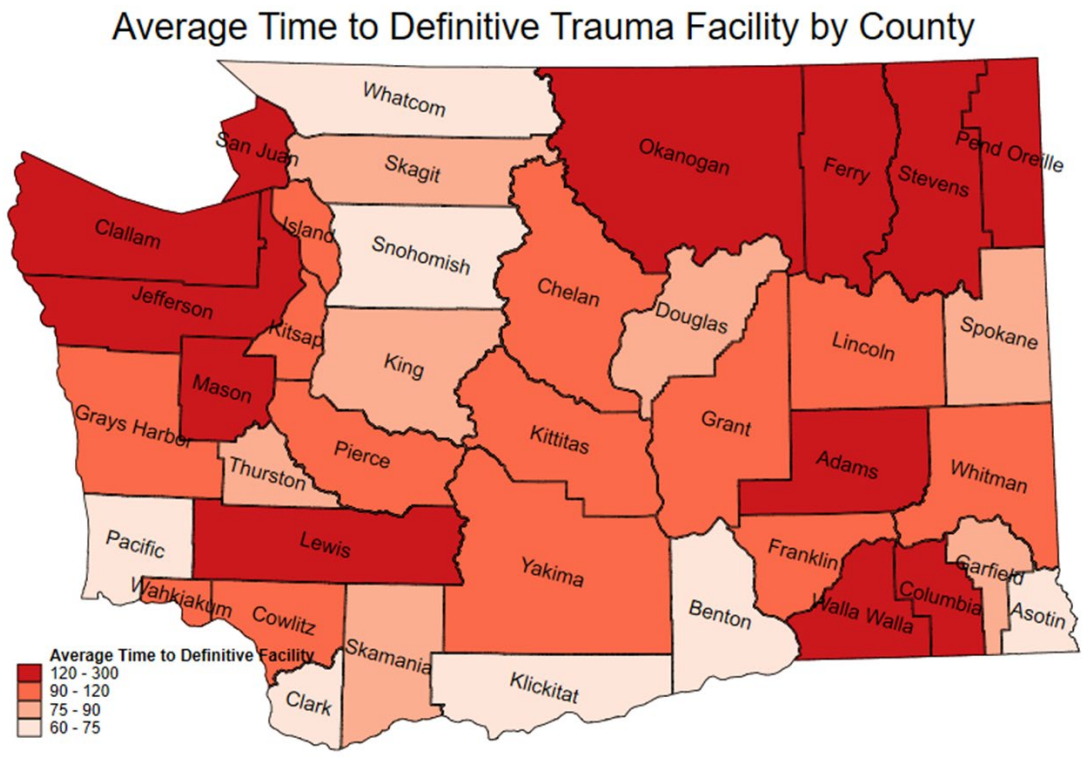


Figure 41 Average Time to Definitive Trauma Facility by County[2,3]

Figure 38 shows the average time to definitive trauma facility by ISS. While patients with an ISS of 15 or lower reach their definitive care facility on average in 80 minutes, patients with an ISS of 16 or higher reach their definitive trauma facility in 124 minutes. This is likely due to higher severity trauma patients being more likely to require transfer to a higher level of care.

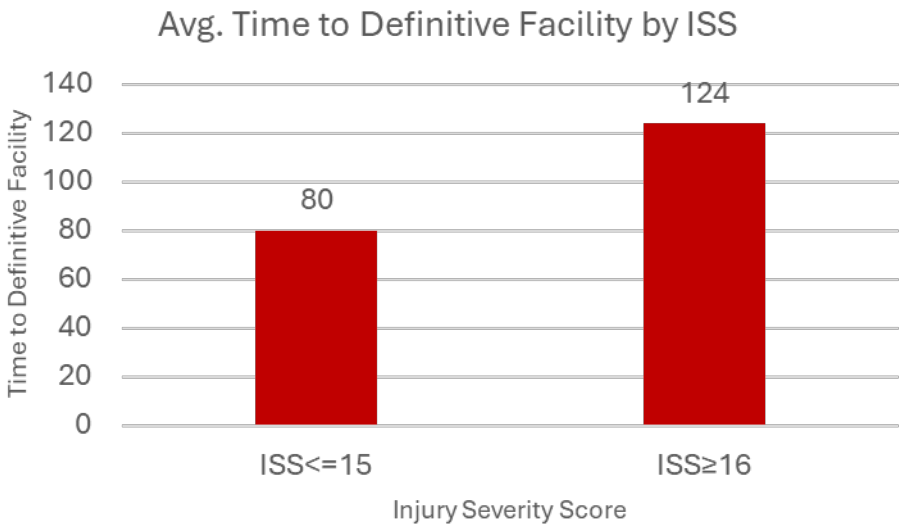


Figure 42 Average Time to Definitive Trauma Facility by Injury Severity Score[2,3]

The increased time required to transfer to higher levels of care is highlighted in figure 44, which shows the average time to definitive care by the level of the definitive trauma facility. While patients whose definitive trauma facility is a level 5 reach that facility in 47 minutes on average, patients whose definitive trauma facility is level 1 reach that facility in 163 minutes on average. Longer times to definitive care at higher level facilities (levels I and II) can in part be explained by the higher volume of patients transferred to these facilities to receive a higher level of care and the more dispersed locations of these facilities across the state. Another contributing factor to time to definitive care is the need to transfer a patient out of the region of injury. Patients transferred out of region have a longer average time to definitive care compared to those transferred within their region. (Figure 45) Transfers to out of state facilities or undocumented destinations have been excluded due to unavailability of data.

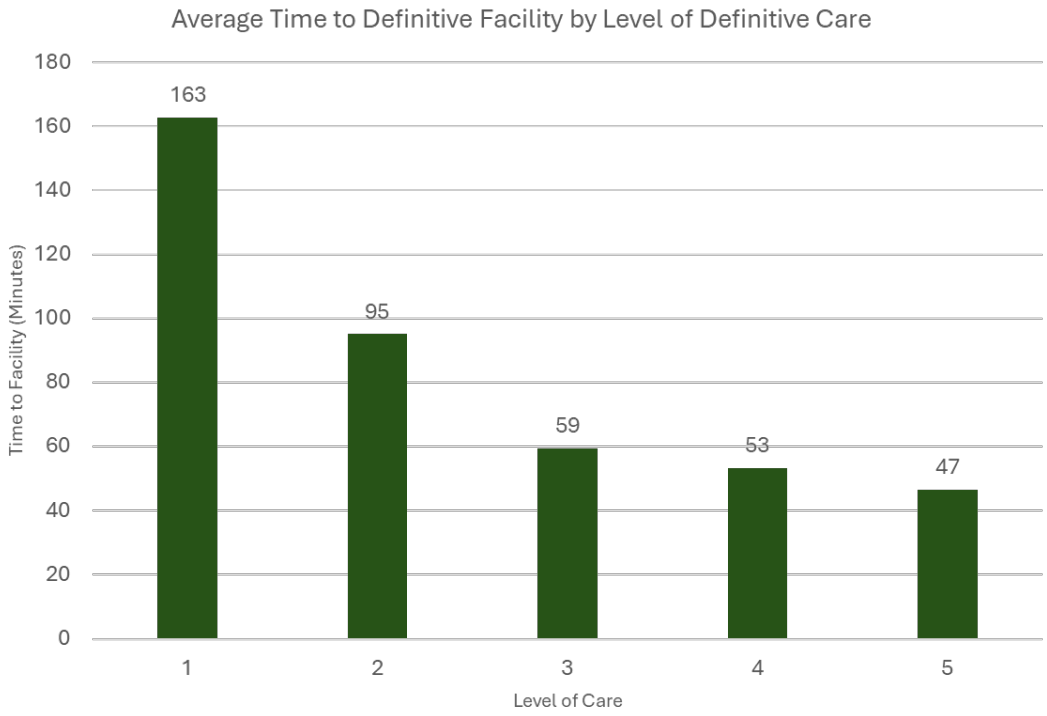


Figure 43 Average Time to Definitive Facility by Facility Level of Care[2,3]

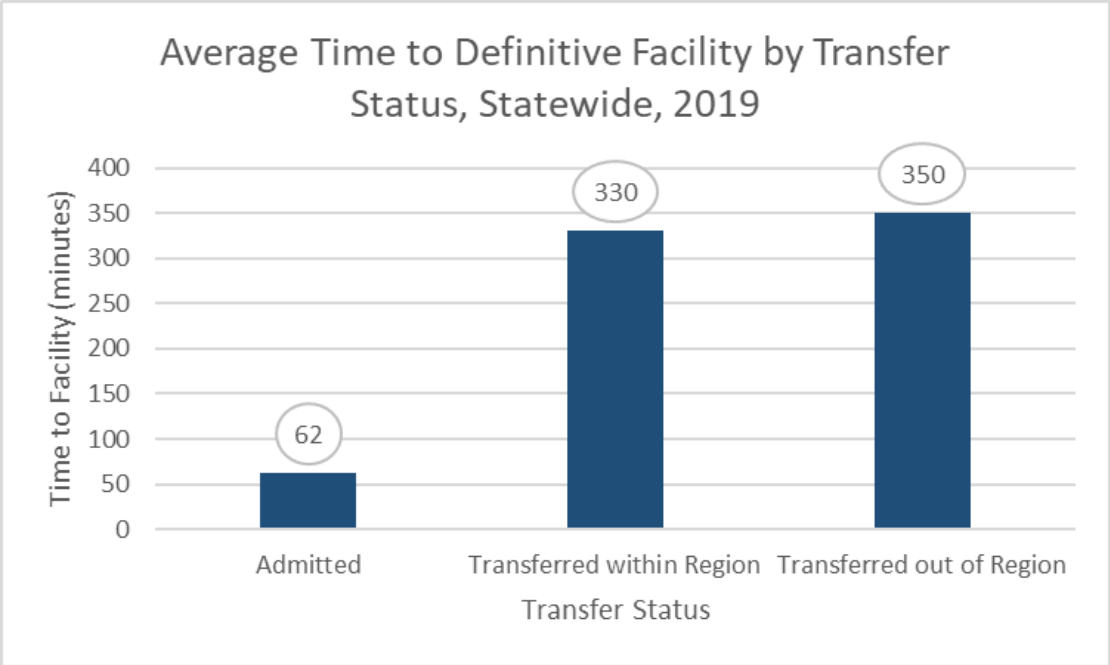


Figure 44 Average Time to Definitive Facility by Transfer Status[2,3]

Outcomes:

Overall, after adjusting for age, in-hospital mortality rates among trauma patients have been in a slight decline between 2009 and 2019.

Risk adjusted in-hospital mortality showed little to know differences between facilities and between facilities, though one higher level center was found to have lower than average mortality while one level III center was found to have higher than average.

Key Question: Is the Washington state trauma system reducing mortality in injured patients?

Mortality Patterns

In 2019, in-hospital mortality among Washington trauma patients was overall more common in males than females across all age groups except for the 85+ years where the distribution was equal in both sexes. (Figure 46)

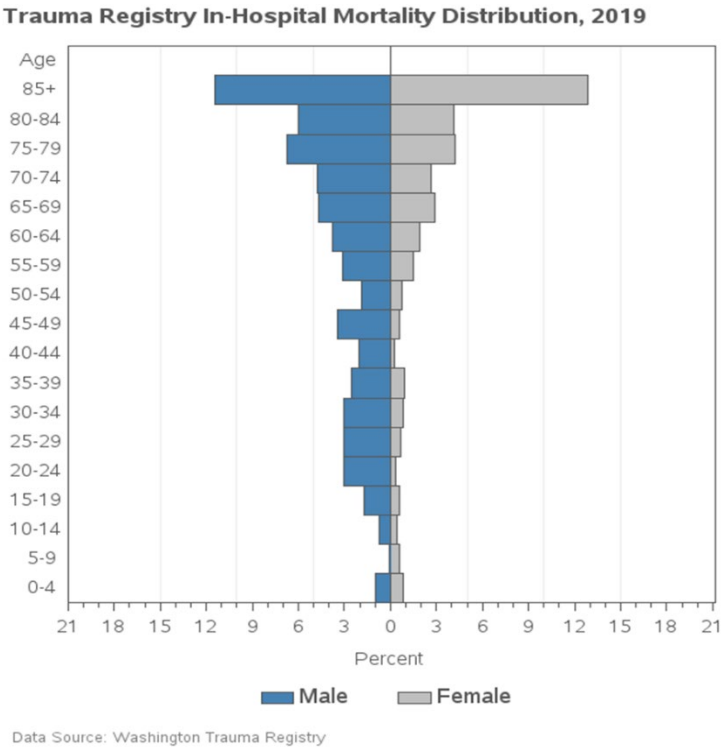


Figure 45 Trauma Registry In-hospital Mortality Distribution, 2019[2]

Over a 10-year period from 2009 to 2019, age-adjusted trauma mortality rates have been relatively constant ranging between 2 and 3 per 100 patients with a slight decline over time in Washington. (Figure 47)

Age-adjusted mortality rates have been higher for males compared to females over the same period, 2009 to 2019. (Figure 48)

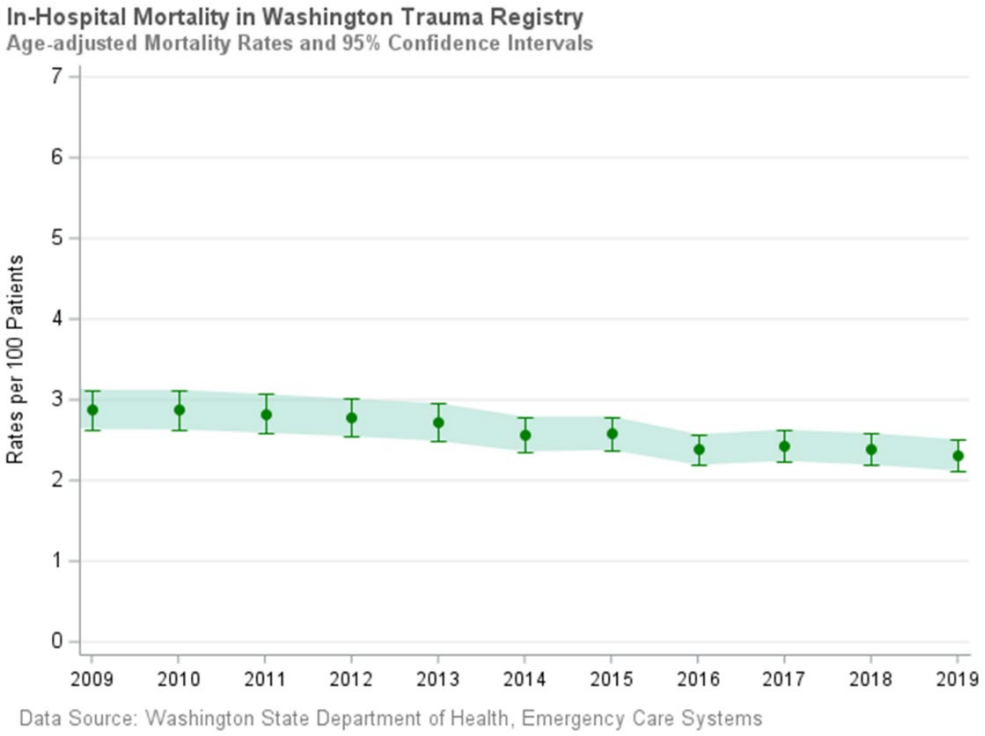


Figure 46 In-hospital Mortality in Washington Trauma Registry (Age-adjusted Rates), 2019[2]

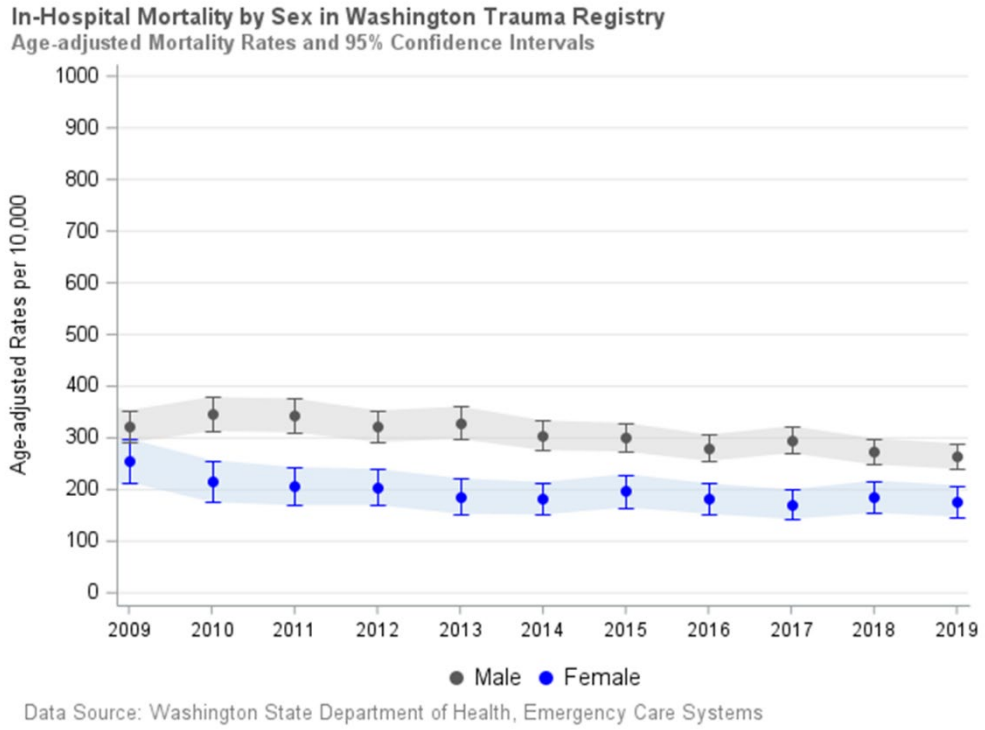


Figure 47 In-hospital Mortality in Washington Trauma Registry (Age-adjusted Rates by Sex), 2019[2]

Risk Adjusted Mortality

Figure 49-51 show the risk-adjusted mortality odds ratios (OR) for each facility at level I & II, level III, and level IV & V adult trauma centers relative to all the facilities combined at the same level. The method used to adjust for risk is based on that used by the American College of Surgeons (ACS) Trauma Quality Improvement Program (TQIP). Adjusting for risk is important in comparing mortality between facilities who may see varying levels of severity among their patient populations. By adjusting for risk, the mortality odds ratios become a better measure of the quality of care. Across regions and facilities, the results indicate a consistent quality of care, though one facility shows lower odds of in-hospital mortality and one shows higher odds compared to the average of similar level trauma centers.

The OR for each facility indicates the odds of in-hospital mortality in the facility compared to all the facilities combined at the same level. An OR above 1 indicates that the odds of in-hospital mortality in the facility is higher than average and an OR below 1 indicates that the odds of in-hospital mortality in the facility is lower than average in the same level. If the confidence interval for the estimate OR is completely above/below the reference line (OR=1), it indicates the odds of in-hospital mortality in the facility is significantly higher/lower than the average (alpha=0.05). The variables considered for risk-adjusted mortality modeling include age, sex, race, ISS, body region, pre-existing conditions, transfer status (admitted or transferred in), initial GCS motor, initial pulse, initial SBP, and mechanism of injury.

Among Levels I & II facilities, one facility showed a statistically significantly lower odds of in-hospital mortality compared to all the facilities combined. (Figure 49)

Among level III facilities, one facility showed a statistically significantly higher odds of in-hospital mortality compared to all the facilities combined. (Figure 50)

Among levels IV&V facilities, no statistically significant difference in odds of in-hospital mortality in each facility compared to all the facilities combined. (Figure 51)

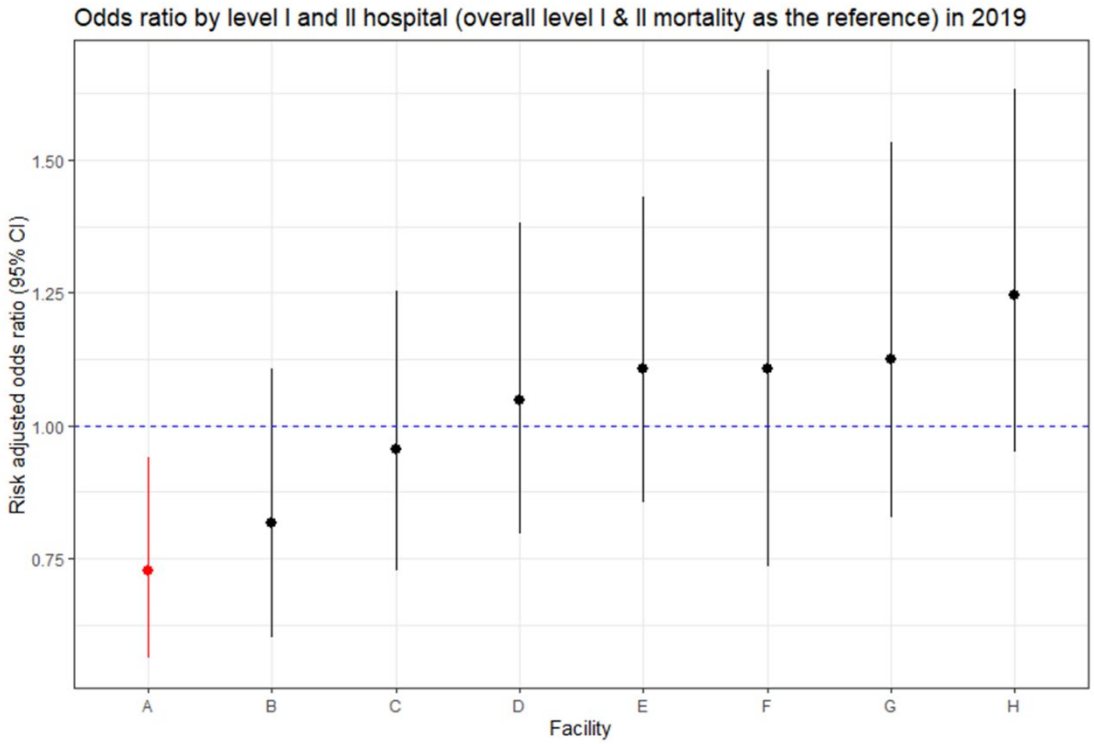


Figure 48 Risk-adjusted Mortality in Washington Trauma Registry, Levels I &II Trauma Centers, 2019[2]

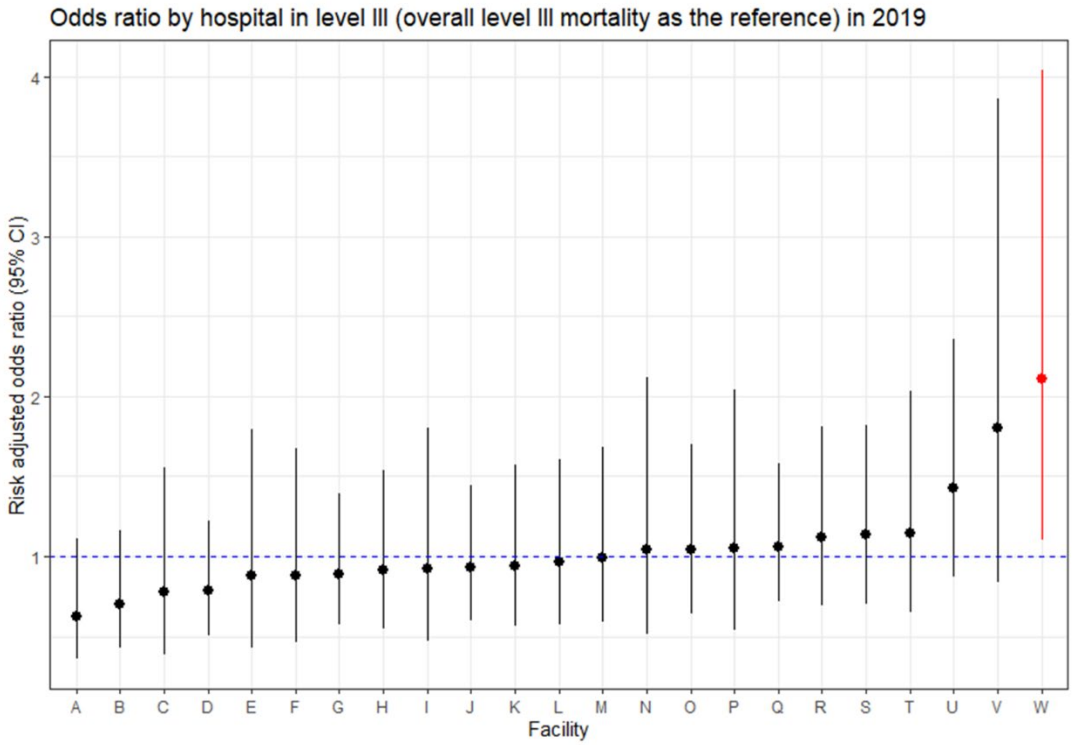


Figure 49 Risk-adjusted Mortality in Washington Trauma Registry, Level III Trauma Centers, 2019[2]

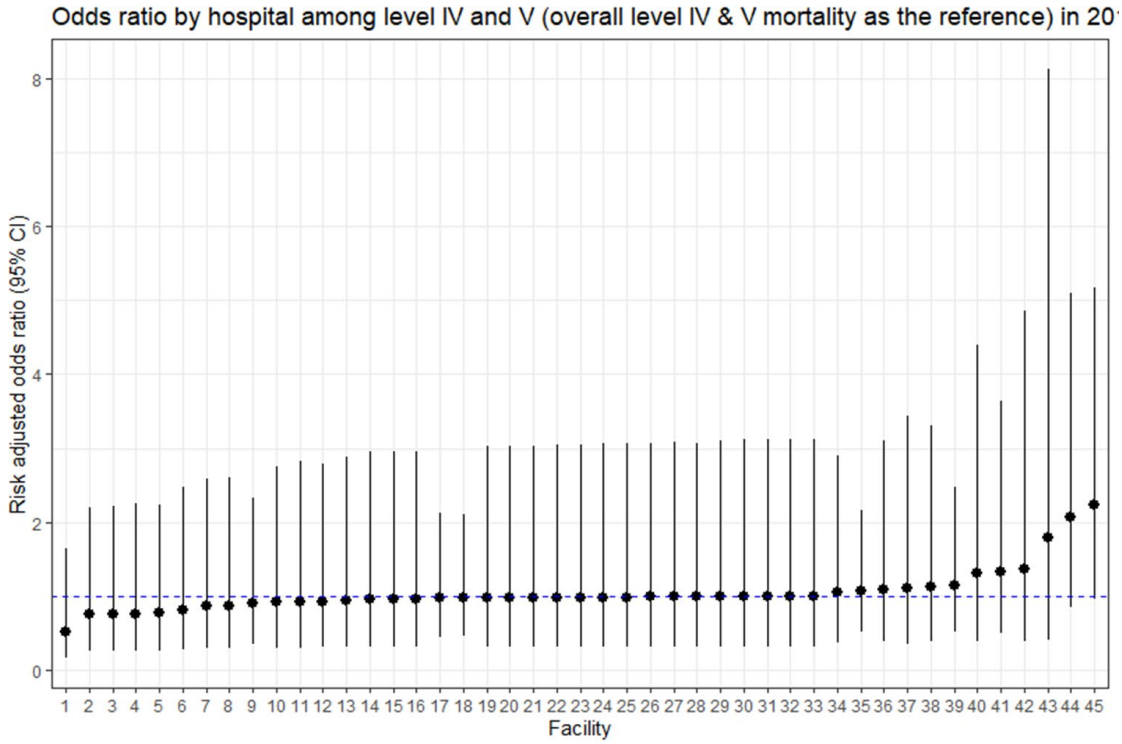


Figure 50 Risk-adjusted Mortality in Washington Trauma Registry, Levels IV & V Trauma Centers, 2019[2]

Cost of Care

Summary

Overall health care costs in Washington and nationally continue to rise at rates higher than inflation, impacting the ability for individuals to pay for services and access the care they need. Understanding how any change to the health care system, including a change in trauma designation for a facility, impacts the cost of care across the system, including non-trauma services, is an important factor to review when assessing trauma designation levels.

Key Question: How does a changing trauma system affect costs in the overall healthcare system?

DRAFT NOTE: The final trauma assessment will include analysis of the impact on costs to the health care system due to changes in facility trauma designation.

Trauma Forecasting

Summary

Incidents of traumatic injury and overall population in Washington State have continued to rise. To adequately plan for necessary resources a forecast of trauma need is planned in collaboration with the Washington Office of Financial Management. This forecast will be included in the final trauma assessment.

Key Question: What will future demands be for the Washington Trauma System?

DRAFT NOTE: The final trauma assessment will include a forecast of trauma.

Regional Planning Guidance

The Washington Trauma System currently has 84 designated trauma centers across eight EMS and Trauma Regions. (Figures 1 and 2) Each region convenes an EMS and Trauma Care Council, responsible for maintaining regional EMS and trauma care plans, which among other purposes, are intended to assess and analyze regional needs around care and resources, and to establish the number and level of trauma centers to be designated in the region based on the availability of resources and distribution of trauma within the region. The Trauma Services Assessment is intended as an aid to regional councils, in identifying and planning for these needs. Regional councils are advised to use this report to support data-driven decisions and planning around regional care and resource needs, including those described in their biennial regional EMS and trauma care plans.

The data contained in this assessment is publicly available and does not contain any information considered confidential under RCW 70.168.090. For this reason, the information provided in this assessment may not be as detailed as is needed to adequately assess the need for changes to the minimum and maximum number of trauma centers needed in a region. To address this, each region may request additional data and information from the Department regarding confidential statistics for their region. Confidential data may only be provided to regional EMS and trauma quality assurance (QA) programs, which are confidential settings protected by statue (RCW 70.168.090). EMS and Trama Care Councils are advised to request this review of confidential data by their QA committees and receive advisement on trauma service needs in their regions based on this.

Assessing the need for minimum/maximum number of trauma centers

It is recommended that each Regional Council and QA committee use this report as well as the suggested questions listed below to guide them in determining the minimum and maximum number of trauma services needed in their region. Department staff in the EMS and Trauma Program are available to provide additional ongoing data and analytic support, including examining and sharing confidential data and information about care in a region with regional QA committee.

If a trauma center were added or had a change in designation:

What is the potential impact on trauma volume to neighboring trauma centers?

How many patients are transferred from the existing center to neighboring centers?
How many patients are transferred out of the region?
How many patients are transferred to a level I? Level II? Level III?

What is the potential impact on timely care delivery for patients?

Will patients likely arrive at their initial care facility in a shorter or longer time?
How many patients are currently transferred from the facility to the level of care being proposed as a designation change?

What is the potential impact to patients and family burden?

How many out of region transfers are transferred more than 60/80/100 miles from the initial care facility?

What is the average length of stay for patients transferred more than 60/80/100 miles from the initial care facility?

What is the impact on trauma patients going to non-designated facilities?

How many trauma patients are transferred within the region from a non-designated facility to a designated facility?

How many of these patients go to which level of centers?

What is the impact on diversion?

How might the number of times current centers go on divert change?

Considerations for future assessment topics

Additional topics have been identified as important for consideration in this assessment but have not been included in this version to-date due time or data limitations. Those areas of focus are expected to be included later. Each of these areas are described below.

Equity:

Key Question: Are trauma services accessible equitably across the state and within regions?

At the time of release of the draft WA Trauma Services Assessment, analysis of data to explore impacts to equity had not yet been conducted. This area is planned for the final version of the report and will consider the following questions:

A) Does access to trauma services differ by race/ethnicity, rurality, or socioeconomic status?
B) Does the under-triage rate differ by race or other sociodemographic groups?
C) Do those in occupations with higher risk of injury have equitable access to timely trauma care?
D) What are the health disparities in Washington that may be influencing timely access to care following injury?
E) What are the impacts of transfer distance on health equity?
    a. How does length of stay exacerbate these impacts?

Bed/Staff Capacity:

Key Question: Do trauma centers have the resources to adequately meet the demand for care?

Though data limitations prevent inclusion of this topic in the 2024 iteration of the WA Trauma Services Assessment, both the bed and staff availability to support trauma care in WA designated trauma centers is an area of analysis that may be explored in future iterations, pending data availability.

Emergency Preparedness:

Key Question: How does the WA Trauma System contribute to emergency preparedness and what is the current capacity of Trauma Services to fulfill this need in the state?

Emergency Preparedness was not included in the scope of this project and will be considered in future iterations of this assessment. Department EMS and Trauma program staff will collaborate with Department Emergency Preparedness staff as well as stakeholders to guide development of this area.

Cost of Care:

Key Question: How does the accessibility of trauma services impact the cost of care to the patient?

This assessment has addressed the impact of the makeup of the trauma system on cost of care to the patient through review of the existing literature. In future iterations of the assessment, it is intended to look further at costs and factors specific to Washington State through secondary data sources.

Key Question: What will future demands be for the Washington Trauma System?

Trauma Forecasting

Summary

Incidents of traumatic injury and overall population in Washington State have continued to rise. To adequately plan for necessary resources a forecast of trauma need is planned in collaboration with the Washington Office of Financial Management. This forecast will be included in the final trauma assessment.

Key Question: What will future demands be for the Washington Trauma System?

Conclusions

The Washington Trauma Services Assessment investigates the demand, accessibility, timeliness, quality, and cost of Trauma Services in Washington State. Key findings from the assessment are summarized here:

1) The population of Washington State is growing, representing a potential increase in trauma incidents and demand on trauma services statewide.
2) Trauma incidents are increasing more rapidly than the population, reinforcing the likely need for increased availability of services in future years.
3) The number of Trauma services has not increased or varied greatly over the past 10 years, despite a continually increasing patient volume.
4) Some level of trauma services (Level I thru V) is accessible to most Washingtonians within 60-minutes, though fewer have access to higher levels of care (Levels I and II) within 30 minutes, as is prescribed in the Washington State Trauma Triage Guidelines for severe trauma.
5) The average time to initial trauma care across the state is approximately 60-minutes, while definitive care is reached on average in 85 minutes. While these times are consistent with current benchmarks, there is variation across regions where geographic distances from higher levels of care pose a possible barrier to efficient care delivery.
6) In-hospital mortality has been slightly decreasing, with little variation between trauma services across the state, demonstrating a consistency in quality of care throughout the trauma system.

DRAFT NOTE: Conclusions provided in this section are intentionally high-level. The final trauma assessment will include a complete conclusions section.

Appendix

A. Glossary of terms

Trauma Registry Inclusion Criteria: All trauma records included in analysis for this assessment meet the Washington Trauma Registry Inclusion Criteria, which defines the parameters for whether a patient record should be submitted to the trauma registry. Not all injuries are included.

Trauma incident: Trauma incidents is an important measure to understand the precise injury count the trauma system must address. To avoid overestimating the injuries in the state, trauma incidents represent a count of the total individual patient incidents in the trauma registry. Therefore, when measuring incidents, a trauma case is counted only once, regardless of the number of times the patient was transferred to other trauma centers.

Trauma volume: Trauma volume is an important measure to understand the demand on each designated trauma center. To avoid underestimating the injuries burden and hospital demand in the state trauma system, Trauma volume represents a count of each patient/hospital interaction. Therefore, when measuring volume, a trauma case is counted twice if the case has been transferred to a second facility or three times if the case has been transferred to a third facility, and so on. This is opposed to the measure of trauma incidents, which would count the transferred patient only once.

Trauma incident rate: Trauma incidents per 100,000 population.

Injury Severity Score (ISS): A scoring system for assessing multiple injuries on a scale from 0 (least severe) to 75 (Most Severe, not survivable). A core of 16 or higher is considered a major or severe injury.

EMS and Trauma Care Regions

East region: Ferry, Stevens, Pend Oreille, Lincoln, Spokane, Adams, Whitman, Garfield, and Asotin Counties

North Central region: Okanogan, Chelan, Douglas, and Grant Counties

South Central region: Kittitas, Yakima, Benton, Franklin, Walla Walla, and Columbia Counties

North region: Whatcom, Skagit, Snohomish, and Island Counties

Central region: King County

West region: Pierce, Thurston, Lewis, Pacific, and Grays Harbor Counties

Southwest region: Wahkiakum, Cowlitz, Skamania, Clark, and Klickitat Counties

Northwest region: Clallam, Jefferson, Mason, and Kitsap Counties

B. Data Sources

1.) Washington State population estimates, 2009-2019, Office of Financial Management Population Estimates (Population estimates | Office of Financial Management (wa.gov)).
2.) Washington State Trauma Registry (WTR) data, 1994-2019, the Washington State Department of Health (Trauma Registry | Washington State Department of Health)
3.) Washington State Emergency Medical Serves Information System (WEMSIS) data, 2019, the Washington State Department of Health (Washington EMS Information System (WEMSIS) | Washington State Department of Health)

C. Literature Summary

Review of Literature related to Trauma System Assessment

The Washington State Trauma System was established to ensure timely and appropriate delivery of emergency medical treatment for people with traumatic injury. Designated trauma centers (trauma services) provide emergency lifesaving trauma care throughout the state. The Trauma System, access, outcomes, and resources must be evaluated to ensure community needs are met.

This literature review aims to summarize current research and highlight methodologies to inform the Trauma System Needs Assessment. It is divided into common themes found in literature.

The methods of assessing trauma systems range from simplistic, resource-based approaches to more complex iterative spatial optimization. Comprehensive resource or regional based models, such as that presented by Nathens et al., analyzed trauma system access across 18 states (including Washington) by comparing statistics across qualitative boundaries. This method is useful for identifying disparities in discharge rates, bed-use, or trauma centers per capita. It also considered treatment in non-designated trauma centers of which Washington has several in urban areas. This study, although aging, should be considered as a reference that could add value to the WA needs assessment.

Needs-Based Assessment of Trauma Systems (NBATS)

The American College of Surgeons (ACS), Needs-Based Assessment of Trauma Systems (NBATS) model, involves attributing points based on Trauma Service Area (TSA) characteristics that identify need. These characteristics include TSA population, median transport times, organization support, volumes of severely injured (ISS>15), patients at non-designated trauma centers, current presence of level I trauma centers, and volumes of severely injured patients at level I and II trauma centers. The assigned points are then translated into recommendations for between one and four trauma centers within the TSA.

In a 2017 study, Uribe-Leitz et al. compared the results of the NBATS model from three California trauma data sources – trauma registry, EMS data, and a survey of local EMS agencies. The model recommendations varied widely from the allocation of trauma centers at the time. In 70% of urban TSAs, the NBATS recommendations were lower than the current number of trauma centers. Meanwhile, the model suggested increasing trauma centers in 88% of rural TSAs. There would probably be similar results in Washington given the number of rural areas in the state.

Focusing instead on injured populations, Dooley et al. used an altered version of NBATS, called NBATS-2, to assess potential coverage increases around Memphis, TN, utilizing GIS software. The authors selected

trauma center candidate hospitals near an existing level I trauma center. Designating an additional level I center nearby the existing center increased coverage within 45 minutes of both injured and total populations by only 1%, while decreasing volume at the existing center by 40%. On the other hand, designating two additional level I trauma centers in rural areas outside of the range of the existing center increased coverage within 45 minutes by at least 13%. While the NBATS-2 method can estimate the impacts to access and existing centers' volume when establishing a new trauma center, the selection of the new trauma center was done subjectively. Further work could repeat this process to select the location that maximizes access. This study and methods should be considered to gauge the impact in Washington and help with decision-making if a facility requests a higher designation near another facility of the same level.

More recently, Dalton et al., used the NBATS tool to evaluate the existing trauma infrastructure across the nation to identify geographical regions in need of additional trauma centers. This study did not fully implement all the components of the NBATS assessment and were unable to obtain "stakeholder support" from all areas across the nation. As a result, they automatically gave each trauma service area full stakeholder support and awarded the full (5) points for that category. There may be a similar issue in identifying stakeholder support here in WA. For that reason, this study and its methodology may be helpful in implementing NBATS into the WA needs assessment.

Access / Geospatial Analysis

Current research on trauma hospital access and trauma center locations is heavily focused on using geospatial analysis and calculating time from injury to arrival at a trauma center.

Branas developed the Trauma Resource Allocation Model for Ambulances and Hospitals (TRAMAH) which was an early attempt to incorporate geographic location of injuries into the assessment of trauma system access. TRAMAH was used to maximize access to trauma centers of Maryland trauma cases, derived from hospital discharge data. The model allowed assessment of either an area without trauma centers or an existing trauma system. At the time, Maryland had 9 existing trauma centers, covering 70% of observed severe injuries within 15 minutes. Optimally replacing 2 of these trauma centers increased coverage by nearly 7%. Though TRAMAH represented a more objective method of selecting trauma center locations, the computational requirements make replication difficult.

TRAMAH was later adapted by Branas to analyze the overall trauma access in 18 states. As of 2005, "an estimated 69% and 84% of all US residents had access to a level I or II trauma center within 45 and 60 minutes, respectively." However, nearly 47 million Americans, mostly in rural areas, had no access within 60 minutes. Similarly, Winchell et al. analyzed access to trauma centers by the overall population but include the addition of trauma hospitals to a hypothetical situation where no trauma centers exist. Once an optimally placed trauma center exists, adding another optimally placed center increased access by 14%, with a 14% decrease in trauma volume at the existing center. Adding a third center increased access by another 4% while further decreasing volumes at the initial center.

A 2014 Pennsylvania (PA) report on trauma needs noted five criteria (access, volume and outcome, population, and injury distributions, staffing availability, and healthcare finances) which spurred research on optimal trauma center placement methods in PA. Horst et al. analyzed all possible configurations of the trauma system from a set of candidate trauma centers and provides a number of options that maximize coverage within a set travel time. The approach estimates the maximum

attainable level of trauma center access, as well as optimal reconfiguring of current trauma resources. For example, the Horst model determined that PA could achieve the same level of access of the 27 existing trauma centers in 2015 by optimally placing only 22 centers. Conversely, adding between one and six trauma centers would increase coverage of trauma incidents within one hour from 91% to 96%, though higher additions would significantly reduce average trauma center volume.

Regional trauma system design aims to identify the most severely injured patients and directs them to the highest levels of care. As such, most studies focus on access to level I and II trauma hospitals for patients with injury severity scores (ISS) greater than 15. While this approach presents an aggregate analysis of severe trauma cases, it does not allow for separate recommendations for level I and II hospitals. The Geospatial Evaluation of Systems of Trauma Care (GEOS) model by Jansen represents a step toward providing objective recommendations for multiple levels of care. Like the Horst model, GEOS analyzes all possible configurations of the trauma system, given a set of candidate trauma centers. However, GEOS assumes a triage approach to separate the most serious trauma patients using recommendations from the 2012 National Expert Panel on Field Triage recommendations by Sasser et al. GEOS then prioritizes coverage of the most severe trauma patients by level I or "major trauma center" access, followed by coverage of other severe trauma cases at level II and III trauma centers. Furthermore, GEOS ignores possibilities where level I centers do not achieve a minimum threshold of severe trauma patients. Jansen's research in 2014, 2015, and 2018 proved the results of the GEOS can be applied to reconfigure existing trauma systems or establish a new trauma system. However, the GEOS model is limited due to being computationally cumbersome and requiring a standard triage method.

Two model inputs commonly vary within models to allow for sensitivity analysis – travel time from the injury location to the trauma center and a minimum volume threshold. Branas's TRAMAH model used considerably shorter travel times of 15 and 30 minutes, while Horst et al. considered access from 45 to 120 minutes. Medrano et al. in the MIMIC study adapted a four-component definition for total prehospital time, which includes activation, response, on-scene, and transport intervals. They defined timely access to care as the ability to reach a trauma center within 60 minutes via ground MES or helicopter EMS locations. A recent geospatial study from Patal et al., developed an association between access to trauma centers (level I-III) and traffic fatalities which demonstrated a positive relationship between delayed access and higher mortality rates following motor vehicle crashes. Predicted access times were operationalized into categories by 15-minute increments (<15, 15-30, 30-45, 45-60, or ≥60). The most commonly compared travel times in all the studies were from 45 to 60 minutes.

A recent study by Medrano et al. and the MIMIC study group was conducted in five states, including Washington, and used GIS and a system-based model that incorporates the entire trauma response to more accurately estimate present and future needs using prehospital time intervals. The author's aim was that the study be used as a blueprint for creating an assessment to better determine geographical gaps and seek to identify optimal location for additional level I and II trauma centers. In 2020, the same MIMIC study group also completed a GIS Mapping Model of Washington State "Washington State Access to Care" using the same methodology as described above. Both of these studies and there methodologies may be helpful to the WA needs assessment.

Another example of Washington State GIS mapping to assess access to trauma centers can be found in the 2019 ACS Washington State Trauma System Consultation Report, starting on page 60. The report uses 60-minute ground transport time and differentiates between all levels. It highlights limited access to level I and II trauma centers, especially in the central and far western parts of the state. The specific methodology details are not included.

The determination of injury location is also a model specification worth considering. With the optimal data, the precise geolocation of incident sites would be used in determining access. However, this approach is not feasible with information available in most trauma-related datasets. As a result, most models use the zip code area centroid of the patient's address as a proxy for incident location. [4, 7, 9, 10] Though occasionally limited by missing location information, only the GEOS model involved analysis by exact incident location. Also, none of the papers considered here incorporate changes in population over time, changes in population density, or volume limits of existing trauma centers.

Trauma Volume

The impacts on patient volumes of established trauma centers are a common concern expressed in the trauma designation literature. Studies from Tempas and Ciesla concluded that establishing a new trauma center may reduce the volumes of nearby trauma centers, especially if trauma cases are trending downward, and may increase trauma staffing costs. In a second study, Tempas concluded that new trauma designations may also impact triage performance and redistribute trauma volume. Beyond the potential impacts to the financial feasibility of the trauma system, Ogola, Haider, and Shafi discovered that decreases in trauma patient volume are generally considered to worsen mortality rates, however, the design of the research may affect the conclusions of these studies.

As a result of volume concerns, advanced trauma system assessment models include restrictions to ensure level I centers treat a minimum number of severely injured trauma patients each year. These thresholds range in Jansen's studies from 240 to 650 severely injured admissions. The ACS Committee on Trauma recommends that level I trauma centers admit a minimum of 1200 trauma patients annually or a minimum of 240 admissions of severely injured (ISS>15) patients. Similarly, Ogola et al. suggest the mortality rate in hospitals treating less than 688 emergency general surgery (EGS) patients was 5%, while the rate at hospitals treating more than 688 EGS patients was 2%. Though results such as this may be influenced by study design, it is important that researchers consider the implications of volume in designing trauma system assessment models.

A systematic review conducted by Sewalt et. al, aimed to evaluate the relationship between hospital and surgeon volume and health outcomes in severely injured patients. They identified eighteen cohort studies conducted from 1980 to 2018. The majority (13) of the studies concluded a positive relationship between higher hospital or surgeon volume and lower mortality rates. Their work confirmed that the ACS requirement for level I facilities to admit at least 240 severely injured patients (ISS > 15) was in fact associated with lower mortality rates.

There was no research discovered which demonstrated whether there was a relationship between high volume centers who are over capacity and increased mortality rates.

Mortality

Risk adjusted mortality models are widely used to assess individual trauma center performance. This is often reported in the American College of Surgeons Trauma Quality Improvement Program (TQIP) risk adjusted benchmarking reports. A retrospective cohort study by Wiebe was conducted in Pennsylvania using the TQIP methodology to perform a statewide morality assessment. The results concluded it is feasible to apply the methodology to statewide assessment efforts and can be used to explore characteristics of trauma centers, patients, and other factors including geography that may influence trauma center performance.

Summary

A report from the Pennsylvania Trauma System Foundation concluded that trauma system design should consider five areas – access, volume and outcome, population, and injury distributions, staffing availability, and healthcare finances. Similarly, the ACS-COT included in their Revised Statement on Trauma Center Designation, that trauma system needs should be assessed using measures of access, quality, population mortality rates, and trauma system efficiency. These recommendations should be used as the foundation for the WA needs assessment. The criteria of staffing, financing, and community support may initially be outside the scope of assessment until a means to collect this data is available.

Most current literature related to trauma system designation and access is based on geospatial analysis. The WA needs assessment should certainly include GIS mapping to highlight timely access to higher levels of care following injury. The time scales most frequently used from the time of injury to arrival at the trauma center are 45 and 60 minutes. Consideration should be given to using 15-minute increments from <15 minutes to > 60 minutes to demonstrate a more complete picture.

The WA needs assessment should also consider the admission volume of severely injured patients at each facility and be aware of the potential consequences if facility volumes are too low or drop below the ACS-COT recommendation of 240 annually severe trauma admissions. In addition, there should be consideration given in the assessment to population and trauma centers per capita. There may also be a need to measure the number of trauma patients treated at non-designated trauma centers.

Lastly, the goal of any trauma system is to prevent mortality and limit disability following injury. Understanding the state and regional mortality rates would add value to the WA needs assessment. Risk adjusted mortality reports are used in the ACS-COT Trauma Outcomes Quality Improvement Program which is considered a world leader in trauma assessment.

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D. Methodology

Data

1. Washington State population estimates, 2009-2019, Office of Financial Management Population Estimates (Population estimates | Office of Financial Management (wa.gov)).
2. Washington State Trauma Registry (WTR) data, 1994-2019, the Washington State Department of Health (Trauma Registry | Washington State Department of Health)
3. Washington State Emergency Medical Serves Information System (WEMSIS) data, 2019, the Washington State Department of Health (Washington EMS Information System (WEMSIS) | Washington State Department of Health)
4. WTR-WEMSIS linked data, 2019. WTR data were linked to WEMSIS data deterministically and probabilistically using the SAS® based The Link King® software (more on linkage methodology below).

Rural-Urban Classification

Secondary Rural-Urban Commuting Area (RUCA) codes based on Scheme 1 in the Guidelines For Using Rural-Urban Classification Systems for Public Health Assessment (wa.gov) were used to define urban/rural areas in Washington State. It used both primary and secondary commuting patterns to incorporate the concept of potential access to resources and services in its broadest sense.

Level	Secondary RUCA Codes
Urban core	[1.0, 1.1]
Suburban	[2.0, 2.1, 3.0]
Large rural	[4.0, 4.1, 4.2, 5.0, 5.1, 5.2, 6.0, 6.1]
Small town/rural	[7.0, 7.1, 7.2, 7.3, 7.4, 8.0, 8.1, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2,10.0, 10.1, 10.2, 10.3, 10.4, 10.5, 10.6]

Note: When using scheme 1, based on census tracts, [53003960600] might be re-classified to Suburban; and [53003960100 and 53003960200] re-classified to small-town/rural.

The Rural-Urban Commuting Area codes can be downloaded from the US Department of Agriculture. USDA ERS - Rural-Urban Commuting Area Codes

Linkage Methodology

In the trauma registry, records are submitted pertaining to the care provided by each trauma facility, and any analysis of the care a patient received within the trauma system requires linkage across records. Additionally, to provide information related to the EMS care received before arriving at a trauma center, the analysis needed to include a linkage to the EMS patient care records reported to WEMSIS. The linkage for this report was conducted using The Link King, an extension of SAS® software. This software performs probabilistic and deterministic linkage between data sources as well as across records within a data source. To lessen the processing requirements of the linkage, only EMS records that indicated a traumatic injury were included. Traumatic injury EMS records were identified based on the detection of trauma-related ICD-10 codes in the primary/secondary impression fields. The linkage included 40,376 trauma records from the

Washington Trauma Registry and 424,243 EMS records from WEMSIS. The patient information that was included in the linkage process included patient first, last name, middle initial, date of birth, gender, and the date of the incident.

The linkage resulted in 52,094 records linked to at least one other record, with 36,868 patients identified. Within these linked records, sets of records were then grouped into records pertaining to separate incidents for each patient identified in the linkage. By focusing on these groups of linked records relating to an individual incident, we can assess the quality of the linkage. Of the incidents involving a trauma patient who arrived at the trauma facility by EMS, 67.3% were linked to at least one EMS patient care record and an additional 2.4% matched to another trauma record.

A few factors are likely influencing the linkage rate that will continue to be addressed in future iterations of this work. First, during the time period of the data used in this report, reporting of EMS records to WEMSIS was not mandatory. We estimate that approximately 74-77% of EMS records in Washington were reported to WEMSIS in 2019. Second, only EMS records that indicated a traumatic injury were included in the linkage. Records pertaining to trauma patients but did not include documentation of trauma triage criteria may have been inadvertently excluded in the linkage due to lack of documentation.

Time to Care Analysis

Our analysis of the time to care used the trauma and EMS data resulting from the linkage above. For each linked incident, the time that the first EMS unit was notified of the injury was used as an approximation of the time of the injury. Looking across records, we then identified the earliest time that an EMS unit arrived on scene or at the patient and the time that the first transport unit left the initial scene with the patient. These times, combined with the time that the patient arrived at the trauma facility, were used to calculate the EMS response time, scene time, and transport time, which when combined constitute the time to initial facility. For patients transferred to a higher level of care, we also calculate the time from initial EMS until arrival at the highest level of trauma facility to which the patient was transferred, or the time to definitive care.

Driving time areas

To assess the geographic access to trauma facilities, we used GIS software to generate drive-time area shapefiles that represent the theoretical area that a patient could be transported from to reach each facility within a certain timeframe. These drive-time areas were created within DEPARTMENT's ArcGIS Enterprise application. The drive-time areas analysis tool uses street network data similar to GPS navigation. The setting chosen within this tool included traffic information based on typical conditions for Monday at 12:00 pm and a driving direction toward the trauma centers.

Given that the drive-time would reflect the transport portion of the EMS response, we used our analysis of the time to care to inform the time component of the drive-time areas. We found that the average time from EMS being notified by dispatch to EMS departing the scene of the injury with the patient was 29.2 minutes. Considering the time remaining of "golden hour" following this time to departure of the unit, we chose 30-minutes as the low end of the drive-time areas, with 45- and 60-minute drive-time areas representing access in situations requiring longer drive times.

Two sources of data were used to determine access within the drive-time areas of the trauma facilities. First, the drive-time areas were compared to census block population data via apportionment. Apportionment is a GIS tool that aggregates the population based on the percent contained within a given area. The census block population files were acquired from the US Census files made available by the Washington State Office of Financial Management.

Second, the drive-time areas were compared to geocoded incident locations documented in the EMS records linked to a trauma incident. Because a transported from the initial scene of the EMS response to the trauma facility may involve multiple EMS response scenes, such as transports to a landing zone for further transport via air EMS units, special care was given to identify the initial scene of the EMS response.

All other spatial analysis was completed using ArcGIS® Pro 3.0.0.

Risk-Adjusted Mortality Odds Ratio

The risk-adjusted mortality odds ratios (OR) were estimated using a mixed-effects generalized linear model with random intercept, which accounted for the fact that trauma patients were nested in each trauma center, not randomly assigned to trauma centers. The model was adjusted for patients' age, sex, race/ethnicity, pre-existing conditions, transfer status, initial ED GCS 40 Motor, initial ED pulse, initial ED respiratory rate, initial ED SBP, mechanism of injury, ISS, and injury body region.

All tests of hypotheses were two-sided and used $\alpha = 0.05$ level of significance. SAS version 9.4 was used in all data analyses.

E. Data Tables

Tables of data contained in figures from report.

Population and Injury

Washington State Population & Trauma Registry Record Volume and Incidents, 1995-2019

YEAR	POPULATION	TOTAL TRAUMA VOLUME	TRAUMA INCIDENTS
1995	5,396,569	6,167	5,514
1996	5,483,103	8,144	7,017
1997	5,579,140	9,351	7,926
1998	5,685,459	10,019	8,569
1999	5,792,214	11,150	9,226
2000	5,894,143	14,020	11,713
2001	5,970,452	15,732	13,361
2002	6,059,698	16,787	14,058
2003	6,126,917	17,996	15,003
2004	6,208,532	19,652	16,109
2005	6,298,797	21,316	17,453
2006	6,420,219	23,934	19,630
2007	6,525,121	23,727	19,219
2008	6,608,234	23,405	18,814
2009	6,672,263	24,632	20,289
2010	6,724,540	24,592	19,970
2011	6,781,477	26,313	21,461
2012	6,835,249	26,842	22,043
2013	6,909,445	28,387	23,593
2014	7,005,209	31,125	26,021
2015	7,106,620	33,003	27,775
2016	7,237,219	34,685	29,407
2017	7,344,073	36,395	31,034
2018	7,463,479	38,405	33,164
2019	7,581,818	40,376	35,029

Table 1: Washington State Population & Trauma Registry Record Volume and Incidents, 1995-2019

Adult Trauma Centers by Designated Level of Care, 1999-2020

YEAR	DESIGNATION LEVEL				
	Level I	Level II	Level III	Level IV	Level V
1999	1	7	18	33	14
2000	1	8	19	33	15
2001	1	8	21	32	15
2002	1	8	21	33	14
2003	1	8	21	32	13
2004	1	7	21	33	13
2005	1	7	20	34	14
2006	1	6	21	34	13
2007	1	6	21	34	13
2008	1	4	24	33	14
2009	1	4	23	33	15
2010	1	4	23	34	15
2011	1	4	23	35	15
2012	1	4	25	33	16
2013	1	4	26	33	16
2014	1	6	24	33	16
2015	1	6	24	33	16
2016	1	6	24	36	13
2017	1	6	24	38	13
2018	1	6	23	38	13
2019	1	6	24	36	13
2020	1	6	23	36	13

Table 2: Adult Trauma Centers by Designated Level of Care, 1999-2020

Trauma Incident Counts by Level of First Facility

YEAR	LEVEL I	LEVEL II	LEVEL III	LEVEL IV	LEVEL V	TOTAL
1995	2,461	1,656	1,098	672	15	5,902
1996	2,463	1,793	1,776	1,531	57	7,620
1997	2,522	2,142	2,216	1,665	86	8,631
1998	2,829	2,315	2,407	1,574	95	9,220
1999	2,578	2,951	2,836	1,560	175	10,100
2000	2,735	4,052	3,762	1,760	234	12,543
2001	2,899	4,808	4,305	1,813	315	14,140
2002	2,968	4,997	4,735	2,049	287	15,036
2003	3,061	4,927	5,612	2,042	348	15,990
2004	3,022	5,058	6,315	2,672	268	17,335
2005	3,374	4,976	7,191	2,913	311	18,765
2006	4,273	5,542	7,669	3,084	426	20,994
2007	3,747	5,266	8,084	3,169	399	20,665
2008	3,566	4,574	8,387	3,349	393	20,269
2009	3,518	4,996	8,755	3,561	814	21,644
2010	2,993	4,456	9,104	4,281	477	21,311

2011	2,901	4,649	10,892	4,046	529	23,017
2012	2,934	4,831	11,094	4,114	494	23,467
2013	2,904	5,105	12,133	4,467	547	25,156
2014	2,748	6,855	12,333	5,319	547	27,802
2015	3,045	7,955	12,414	5,505	466	29,385
2016	3,113	8,751	12,781	5,598	603	30,846
2017	3,323	8,937	13,220	6,422	560	32,462
2018	3,310	9,509	13,408	7,614	537	34,378
2019	3,242	10,824	14,014	7,656	522	36,258

Table 3: Trauma Incident Counts by Level of First Facility, 1995-2019

Trauma Incident Counts by Level of Final Facility

YEAR	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	TOTAL
1995	2,548	1,534	830	483	2	5,425
1996	2,746	1,703	1,393	1,016	7	6,942
1997	2,946	1,944	1,721	1,091	17	7,825
1998	3,329	2,245	1,885	926	8	8,458
1999	3,216	2,805	2,189	777	29	9,097
2000	3,653	3,934	3,012	810	51	11,541
2001	3,957	4,728	3,450	890	117	13,165
2002	4,212	4,996	3,643	990	62	13,903
2003	4,541	4,897	4,328	969	140	14,875
2004	4,688	5,064	4,955	1,210	49	15,966
2005	5,173	5,020	5,786	1,271	67	17,317
2006	6,367	5,714	6,093	1,173	137	19,484
2007	5,920	5,515	6,260	1,273	102	19,070
2008	5,719	4,904	6,442	1,540	79	18,684
2009	5,536	5,276	6,911	1,900	528	20,181
2010	5,087	4,963	7,251	2,282	181	19,871
2011	4,897	5,232	9,042	2,013	177	21,361
2012	4,964	5,488	9,184	2,202	122	21,960
2013	4,774	5,808	10,149	2,636	155	23,522
2014	4,549	7,359	10,439	3,390	190	25,927
2015	5,137	8,496	10,384	3,437	178	27,632
2016	5,384	9,271	10,569	3,655	272	29,151
2017	5,565	9,597	11,068	4,297	262	30,789
2018	5,467	10,408	11,398	5,333	170	32,776
2019	5,195	12,063	11,862	5,372	168	34,660

Table 4: Trauma Incident Counts by Level of Final Facility, 1995-2019

EMS & Trauma Regional Population

	CENTRAL	EAST	NORTH	NORTH CENTRAL	NORTHWEST	SOUTH CENTRAL	SOUTHWEST	WEST
2010	1,931,249	633,267	1,125,651	241,124	413,108	600,345	563,135	1,216,661
2011	1,945,686	636,665	1,137,497	242,551	413,651	606,932	566,999	1,231,496
2012	1,956,755	641,930	1,147,130	243,862	417,325	612,962	571,296	1,243,989
2013	1,983,550	648,087	1,160,326	245,222	418,536	619,701	576,508	1,257,515
2014	2,021,027	654,753	1,171,550	247,371	422,424	628,277	584,814	1,274,993
2015	2,061,981	661,829	1,189,967	249,228	426,327	633,311	593,783	1,290,194
2016	2,118,958	669,284	1,208,567	251,262	432,461	639,390	604,219	1,313,078
2017	2,149,910	679,358	1,227,993	253,507	436,030	646,778	616,312	1,334,185
2018	2,187,460	690,997	1,249,456	257,177	441,766	655,199	626,526	1,354,898
2019	2,227,755	701,353	1,269,721	259,825	446,546	663,585	638,341	1,374,692
2020	2,269,675	710,396	1,288,972	263,306	451,469	673,354	652,802	1,396,336
2021	2,287,050	710,750	1,299,050	266,700	454,300	677,125	663,825	1,408,175
2022	2,317,700	723,525	1,316,050	269,150	458,075	685,775	672,825	1,421,300
2023	2,347,800	728,350	1,334,100	272,300	461,700	692,150	680,200	1,434,550

Table 5: EMS & Trauma Regional Population, 2010-2023

Regional Percent Change of Population & Trauma Incidents

REGION	% CHANGE POPULATION 2010-2019	% CHANGE TRAUMA RATES 2010-2019
CENTRAL	15%	26.0%
EAST	11%	114.6%
NORTH	13%	132.1%
NORTH CENTRAL	8%	3.4%
NORTHWEST	8%	58.7%
SOUTH CENTRAL	11%	36.9%
SOUTHWEST	13%	4.1%
WEST	13%	41.8%

Table 6: Regional Percent Change of Population & Trauma Incidents, 2010-2019

Rurality population Percent Change, State and Regions

	LARGE RURAL TOWN	SMALL TOWN/RURAL	SUB-URBAN	URBAN CORE
CENTRAL	N/A	18%	12%	18%
EAST	1%	10%	16%	13%
NORTH	15%	11%	18%	18%
NORTH CENTRAL	2%	17%	7%	13%
NORTHWEST	8%	8%	10%	11%
SOUTH CENTRAL	7%	12%	19%	15%
SOUTHWEST	N/A	12%	18%	18%
WEST	7%	11%	11%	16%
STATE	9%	12%	16%	16%

Table 7: Rurality population Percent Change, State and Regions, 2010-2023

Sate Population by Age Group

AGE-GROUP	TOTAL	MALE	FEMALE
0-14	1,398,484	715,781	682,703
15-64	5,055,551	2,555,198	2,500,353
65+	1,252,275	573,307	678,968

Table 8: State Population by Age-group & Sex, 2020

State & Regional Projected Population Growth 2020-2030 (%Change)

REGION	AGE	% CHANGE TOTAL	% CHANGE MALE	% CHANGE FEMALE
CENTRAL	***0-14***	-6.6	-6.4	-6.8
	15-64	7.7	7.6	7.7
	65+	40.0	44.9	36.1
EAST	***0-14***	2.0	1.5	2.6
	15-64	2.5	3.0	2.0
	65+	34.6	35.0	34.4
NORTH	***0-14***	5.3	5.1	5.5
	15-64	6.0	6.3	5.6
	65+	42.8	45.3	40.8
NORTH CENTRAL	***0-14***	-1.7	-2.0	-1.3
	15-64	5.2	5.2	5.2
	65+	37.4	38.2	36.6
NORTHWEST	***0-14***	7.6	7.1	8.2
	15-64	0.2	1.2	-0.9
	65+	29.3	26.7	31.5
SOUTH CENTRAL	***0-14***	1.3	1.2	1.4
	15-64	8.1	8.4	7.8
	65+	32.4	32.5	32.3
SOUTHWEST	***0-14***	1.5	1.5	1.4
	15-64	9.4	9.6	9.1
	65+	43.5	43.4	43.6
WEST	***0-14***	0.6	0.4	0.8
	15-64	6.1	6.7	5.5
	65+	37.0	38.3	36.0
STATE	***0-14***	0.0	-0.1	0.1
	15-64	6.3	6.6	6.0
	65+	38.1	39.7	36.7

Table 9: State & Regional Projected Population Growth (%Change), 2020-2030

WA Population by Age Group

	PEDIATRIC (0-14)	TEEN/ADULT (15-64)	GERIATRIC (65+)	ALL AGES
1995	1,171,184	3,606,003	619,382	5,396,569
1996	1,185,143	3,671,516	626,444	5,483,103
1997	1,201,163	3,743,371	634,606	5,579,140
1998	1,219,416	3,822,109	643,934	5,685,459
1999	1,237,746	3,901,157	653,311	5,792,214
2000	1,255,046	3,976,955	662,142	5,894,143
2001	1,258,899	4,033,622	677,931	5,970,452
2002	1,265,480	4,099,030	695,188	6,059,698
2003	1,267,482	4,149,530	709,905	6,126,917
2004	1,272,498	4,209,758	726,276	6,208,532
2005	1,279,266	4,275,865	743,666	6,298,797
2006	1,292,283	4,363,158	764,778	6,420,219
2007	1,301,866	4,439,267	783,988	6,525,121
2008	1,307,070	4,500,566	800,598	6,608,234
2009	1,308,527	4,548,856	814,880	6,672,263
2010	1,307,767	4,589,096	827,677	6,724,540
2011	1,309,967	4,618,455	853,055	6,781,477
2012	1,312,057	4,626,618	896,574	6,835,249
2013	1,319,177	4,649,205	941,063	6,909,445
2014	1,330,510	4,689,584	985,115	7,005,209
2015	1,343,468	4,732,525	1,030,627	7,106,620
2016	1,364,433	4,795,704	1,077,082	7,237,219
2017	1,381,308	4,838,558	1,124,207	7,344,073
2018	1,398,520	4,888,056	1,176,903	7,463,479
2019	1,412,011	4,939,673	1,230,134	7,581,818

Table 10: WA Population by Age-group, 1995-2019

Patient Volume in WA Trauma Registry by Age-group

	PEDIATRIC (0-14)	TEEN/ADULT (15-64)	GERIATRIC (65+)	ALL AGES
1995	822	3,450	1,153	5,425
1996	963	4,193	1,786	6,942
1997	951	4,733	2,141	7,825
1998	1,046	5,285	2,127	8,458
1999	1,295	5,609	2,193	9,097
2000	1,693	7,146	2,702	11,541
2001	1,924	8,053	3,188	13,165
2002	2,101	8,663	3,139	13,903
2003	2,142	9,230	3,503	14,875
2004	2,136	9,748	4,082	15,966
2005	2,256	10,293	4,768	17,317
2006	2,279	12,489	4,716	19,484
2007	2,275	12,218	4,577	19,070
2008	2,120	11,681	4,883	18,684

2009	2,407	12,117	5,657	20,181
2010	2,489	11,492	5,890	19,871
2011	2,675	12,217	6,469	21,361
2012	2,574	12,658	6,728	21,960
2013	2,483	13,083	7,956	23,522
2014	2,432	14,342	9,153	25,927
2015	2,670	15,483	9,479	27,632
2016	2,528	16,325	10,298	29,151
2017	2,508	16,367	11,914	30,789
2018	2,470	16,678	13,628	32,776
2019	2,489	16,825	15,346	34,660

Table 11: Patient Volume in WA Trauma Registry by Age-group, 1995-2019

Access to Trauma Services

Trauma Designated Centers by Level & Region

REGION	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	TOTAL BY REGION
CENTRAL	1	0	4	3	2	10
EAST	0	1	4	5	7	17
NORTH CENTRAL	0	0	2	6	2	10
NORTH	0	2	2	6	0	10
NORTHWEST	0	0	2	3	0	5
SOUTH CENTRAL	0	1	3	5	1	10
SOUTHWEST	0	1	1	3	0	5
WEST	0	3	3	5	2	13
STATE	1	8	21	36	14	80

Table 12: Trauma Designated Centers by Level & Region, 2024

Patient Flow in Trauma registry by Level of Care,

CENTER LEVEL	PATIENT FLOW	COUNTS	PERCENT
LEVEL 1	Transferred out (in region)	28	1%
	Transferred out (out of region)	<10	<1%
	Admitted (no transfers)	2240	43%
	Transferred in (in region)	866	16%
	Transferred in (out of region)	1987	38%
	Transferred in (unknown)	131	2%
LEVEL 2	Transferred out (in region)	28	<1%
	Transferred out (out of region)	378	3%
	Transferred out (unknown)	25	<1%
	Admitted (no transfers)	9700	77%
	Transferred in (in region)	1497	12%
	Transferred in (out of region)	852	7%
	Transferred in (unknown)	185	1%
LEVEL 3	Transferred out (in region)	1022	7%
	Transferred out (out of region)	1238	9%
	Transferred out (unknown)	54	<1%
	Admitted (no transfers)	11426	80%
	Transferred in (in region)	311	2%
	Transferred in (out of region)	75	1%
	Transferred in (unknown)	134	1%
LEVEL 4	Transferred out (in region)	1201	16%
	Transferred out (out of region)	1005	13%
	Transferred out (unknown)	10	<1%
	Admitted (no transfers)	5450	71%
	Transferred in (in region)	<10	<1%
	Transferred in (out of region)	<10	<1%
	Transferred in (unknown)	<10	<1%

LEVEL 5	Transferred out (in region)	192	37%
	Transferred out (out of region)	161	31%
	Transferred out (unknown)	1	<1%
	Admitted (no transfers)	168	32%

Table 13: Patient Flow in Trauma registry by Level of Care, 2019

Leading Mechanisms of Injury in Trauma Patients, Rates/100,000 populations

YEAR	FALLS	MOTOR VEHICLE TRAFFIC	TRANSPORT, ALL OTHER	STRUCK BY OR AGAINST
1995	31.1	34.1	3.4	6.6
1996	45.4	40.9	4.9	8.4
1997	50.4	45.3	5.9	9
1998	51.5	49.2	7.3	8.9
1999	54.7	50.2	8.7	9.6
2000	70.5	62.4	10.5	12.7
2001	83.3	70.5	12.3	13.7
2002	88	72.2	13.1	14.7
2003	94.6	74.4	15	14.6
2004	103.3	76.4	16	14.8
2005	114.2	80.3	16	17
2006	121.1	90.7	17.2	20.8
2007	117.1	84.4	17.9	20.2
2008	122	72.8	16.7	19.4
2009	135.3	75.7	17.7	20.5
2010	135.6	70.7	17.2	17.9
2011	147.9	77.1	18.5	18.1
2012	150.4	83.9	16.6	18.8
2013	167.6	85.4	17.9	17.6
2014	185.1	95.2	18.4	18.6
2015	182.4	93.9	25.4	18.1
2016	194.3	94.9	32	18.8
2017	213.6	102.1	25.1	17.5
2018	232.7	100.9	24.3	17.7
2019	251.4	100.3	24.4	17.9

Table 14: Leading Mechanisms of Injury in Trauma Patients, Rates/100,000 populations

Regional Trauma Incident Access to Trauma Care,

REGION	DRIVING TIMES	INCIDENT ACCESS LEVELS I&II	INCIDENT ACCESS LEVELS I, II, &III	INCIDENT ACCESS ANY LEVEL
CENTRAL	30 min	91%	98%	99%
	45 min	98%	99%	100%
	60 min	99%	99%	100%
EAST	30 min	84%	88%	95%
	45 min	89%	94%	99%
	60 min	93%	97%	100%
NORTH	30 min	70%	87%	93%
	45 min	86%	93%	97%
	60 min	92%	95%	98%
NORTH CENTRAL	30 min	0%	54%	83%
	45 min	1%	70%	91%
	60 min	6%	80%	97%
NORTHWEST	30 min	7%	75%	84%
	45 min	38%	90%	95%
	60 min	61%	95%	99%
SOUTH CENTRAL	30 min	33%	84%	95%
	45 min	38%	93%	98%
	60 min	42%	98%	99%
SOUTHWEST	30 min	74%	86%	91%
	45 min	85%	92%	98%
	60 min	94%	95%	100%
WEST	30 min	72%	84%	95%
	45 min	85%	96%	99%
	60 min	92%	98%	100%

Table 15: Regional Trauma Incident Access to Trauma Care, 2019

Regional Severe Trauma Incident (ISS≥16) Access to Trauma care

REGION	DRIVING TIMES	SEVERE INCIDENT ACCESS LEVELS I&II	SEVERE INCIDENT ACCESS LEVELS I, II, &III	SEVERE INCIDENT ACCESS ANY LEVEL
CENTRAL	30 min	90%	98%	99%
	45 min	97%	98%	99%
	60 min	99%	99%	100%
EAST	30 min	77%	81%	94%
	45 min	85%	92%	100%
	60 min	89%	96%	100%
NORTH	30 min	68%	85%	95%
	45 min	83%	90%	98%
	60 min	90%	95%	99%
NORTH CENTRAL	30 min	0%	67%	87%
	45 min	0%	79%	90%

	60 min	3%	87%	100%
NORTHWEST	30 min	8%	66%	87%
	45 min	38%	80%	91%
	60 min	70%	91%	99%
SOUTH CENTRAL	30 min	18%	79%	95%
	45 min	22%	94%	99%
	60 min	32%	97%	99%
SOUTHWEST	30 min	67%	82%	88%
	45 min	84%	91%	98%
	60 min	93%	94%	100%
WEST	30 min	61%	78%	93%
	45 min	79%	94%	99%
	60 min	89%	99%	100%

Table 16: Regional Severe Trauma Incident (ISS≥16) Access to Trauma care, 2019

Volume by Transport Type from Scene

		ALL INCIDENTS		ISS >=16		INJURY SEVERITY SCORE	
YEAR	Transport Type	Count	Percent	Count	Percent	Median ISS	Mean ISS
2009	Ground	13345	95%	2464	87%	9	9.6
2009	Air	702	5%	369	13%	17	19.4
2010	Ground	13596	96%	2419	88%	9	9.3
2010	Air	617	4%	316	12%	16	19.1
2011	Ground	14655	96%	1809	87%	5	8.0
2011	Air	674	4%	269	13%	12	15.3
2012	Ground	15374	96%	2010	88%	5	8.2
2012	Air	658	4%	263	12%	11	14.8
2013	Ground	16512	96%	1965	90%	5	7.7
2013	Air	622	4%	214	10%	10	14.2
2014	Ground	18000	96%	2054	88%	5	7.5
2014	Air	705	4%	280	12%	11	14.9
2015	Ground	18960	96%	2193	89%	5	7.5
2015	Air	784	4%	284	11%	10	13.9
2016	Ground	19930	96%	2376	89%	5	7.5
2016	Air	733	4%	304	11%	12	15.4
2017	Ground	21286	97%	2432	89%	5	7.5
2017	Air	750	3%	309	11%	12	15.3
2018	Ground	22681	97%	2423	89%	5	7.3
2018	Air	743	3%	288	11%	10	14.6
2019	Ground	23380	97%	2526	90%	5	7.3
2019	Air	717	3%	273	10%	10	14.8

Table 17: Volume by Transport Type from Scene

Volume by Transport Type-Interfacility Transfers

		ALL INCIDENTS		INJURY SEVERITY SCORE	
YEAR	Transport Type	Count	Percent	Mean ISS	Median ISS
2009	Ground	3425	69%	9	11.0
2009	Air	1505	31%	17	18.5
2010	Ground	3433	71%	9	10.3
2010	Air	1380	29%	16	17.5
2011	Ground	3731	75%	8	8.8
2011	Air	1271	25%	13	15.9
2012	Ground	3721	75%	9	9.1
2012	Air	1269	25%	14	16.3
2013	Ground	3700	77%	9	9.2
2013	Air	1134	23%	16	17.3
2014	Ground	3721	76%	9	9.4
2014	Air	1176	24%	14	16.3
2015	Ground	3797	74%	9	9.8
2015	Air	1349	26%	14	16.5
2016	Ground	4038	74%	9	9.8
2016	Air	1435	26%	14	15.8
2017	Ground	4123	76%	9	10.3
2017	Air	1329	24%	14	16.0
2018	Ground	4223	75%	9	9.9
2018	Air	1400	25%	14	16.2
2019	Ground	4688	78%	9	10.0
2019	Air	1290	22%	14	16.1

Table 18: Volume by Transport Type-Interfacility Transfers

Air EMS Transports from Scene by Injury Region and Receiving Region, 2019

INJURY REGION	RECEIVING REGION	COUNTS	PERCENT
CENTRAL	Central	53	96%
	North	1	2%
	North Central	1	2%
NORTH	Central	56	51%
	North	52	48%
	North Central	1	1%
NORTH CENTRAL	Central	9	21%
	North Central	27	64%
	South Central	5	12%
	East	1	2%
NORTHWEST	Central	170	95%
	North	3	2%
	North Central	1	1%
	Northwest	2	1%
	West	3	2%
<SOUTH CENTRAL	Central	19	32%
	North Central	1	2%
	South Central	39	66%
SOUTHWEST	Central	1	6%
	South Central	1	6%
	Southwest	15	88%
EAST	Central	1	1%
	North Central	5	6%
	South Central	2	2%
	East	75	90%
WEST	Central	57	75%
	North Central	1	1%
	Southwest	4	5%
	West	14	18%
UNKNOWN/OUT OF STATE	Central	4	4%
	North Central	3	3%
	South Central	45	46%
	Southwest	1	1%
	East	44	45%

Table 19: Air EMS Transports from Scene by Injury Region and Receiving Region, 2019

Ground EMS Transports from Scene by Injury Region and Receiving Region, 2019

INJURY REGION	RECEIVING REGION	COUNTS	PERCENT
CENTRAL	Central	5295	97%
	North	79	1%
	North Central	8	0.1%
	Northwest	15	0.3%
	Southwest	2	0.04%
	West	39	1%
NORTH	Central	238	5%
	North	4462	95%
	North Central	2	0.04%
	Northwest	8	0.2%
	West	5	0.1%
NORTH CENTRAL	North	3	0.5%
	North Central	540	96%
	South Central	17	3%
	East	3	0.5%
	West	1	0.2%
NORTHWEST	Central	9	1%
	North	1	0.1%
	North Central	1	0.1%
	Northwest	930	83%
	Southwest	1	0.1%
	West	183	16%
SOUTH CENTRAL	Central	31	2%
	North	1	0.1%
	North Central	10	1%
	South Central	1525	97%
	Southwest	1	0.1%
	West	1	0.1%
SOUTHWEST	North Central	1	0.1%
	South Central	1	0.1%
	Southwest	1978	100%
	West	1	0.1%
EAST	North	1	0.04%
	North Central	4	0.1%
	South Central	9	0.3%
	East	2735	99%
WEST	Central	135	3%
	North	4	0.1%
	North Central	3	0.1%
	Northwest	11	0.3%
	Southwest	57	1%
	West	4187	95%
UNKNOWN/OUT OF STATE	Central	64	8%
	North	73	9%
	North Central	15	2%
	Northwest	12	1%
	South Central	83	10%
	Southwest	120	14%
	East	362	43%
	West	113	13%

Table 20: Ground EMS Transports from Scene by Injury Region and Receiving Region, 2019

Air EMS Interfacility Transfers by Injury Region and Receiving Region, 2019

REFERRING REGION	RECEIVING REGION	COUNTS	PERCENT
CENTRAL	Central	5	100%
NORTH	Central	154	83%
	North	30	16%
	West	1	1%
NORTH CENTRAL	Central	65	47%
	North Central	18	13%
	East	54	39%
NORTHWEST	Central	77	91%
	West	8	9%
SOUTH CENTRAL	Central	197	67%
	South Central	6	2%
	East	88	30%
	West	2	1%
SOUTHWEST	Central	2	9%
	South Central	2	9%
	Southwest	18	82%
EAST	Central	23	20%
	South Central	1	1%
	East	89	79%
WEST	Central	118	81%
	Northwest	1	1%
	Southwest	2	1%
	West	24	17%
OUT OF STATE	Central	140	75%
	South Central	3	2%
	East	42	23%
	West	1	1%
UNKNOWN	Central	58	49%
	South Central	3	3%
	East	58	49%

Table 21: Air EMS Interfacility Transfers by Injury Region and Receiving Region, 2019

Ground EMS Interfacility Transfers by Injury Region and Receiving Region, 2019

GROUND EMS INTERFACILITY TRANSFERS BY INJURY REGION AND RECEIVING REGION, 2019

REFERRING REGION	Receiving Region	Counts	Percent
CENTRAL	Central	889	75%
	North	2	0.2%
	West	295	25%
NORTH	Central	562	76%
	North	178	24%
	West	3	0.4%
NORTH CENTRAL	Central	32	19%
	North Central	49	29%
	South Central	1	1%
	East	85	50%
	West	3	2%
NORTHWEST	Central	152	48%
	North	1	0.3%
	Northwest	3	1%
	West	158	50%
SOUTH CENTRAL	Central	173	63%
	South Central	73	27%
	East	24	9%
	West	4	1%
SOUTHWEST	Central	1	1%
	Southwest	135	99%
	West	1	1%
EAST	Central	8	2%
	South Central	4	1%
	East	422	97%
WEST	Central	292	29%
	Southwest	17	2%
	West	701	69%
OUT OF STATE	Central	5	6%
	South Central	24	28%
	Southwest	10	12%
	East	47	55%
UNKNOWN	Central	121	36%
	North	11	3%
	North Central	1	0.3%
	Northwest	22	7%
	South Central	11	3%
	East	85	25%
	West	83	25%

Table 22: Ground EMS Interfacility Transfers by Injury Region and Receiving Region, 2019

Transport Time by EMS Transport Type

		SCENE TO HOSPITAL ARRIVAL			SENDING TO RECEIVING FACILITY		
YEAR	Transport Type	Count	Median Time	Mean Time	Count	Median Time	Mean Time
2009	Ground	5658	16	20.8	871	50	62.8
	Air	596	24	27.9	1224	49	65.8
2010	Ground	5817	16	19.6	742	46	58.4
	Air	526	28	29.1	1067	50	64.0
2011	Ground	7227	16	19.4	1043	31	49.6
	Air	588	27	35.2	951	54	71.4
2012	Ground	8035	16	19.6	1310	34	49.5
	Air	563	27	30.7	940	50	62.5
2013	Ground	9615	16	19.8	1471	31	46.8
	Air	547	27	31.5	833	53	61.5
2014	Ground	11090	16	19.9	1485	29	44.5
	Air	633	29	31.1	944	50	64.0
2015	Ground	12166	16	19.1	1663	33	49.0
	Air	682	31.5	33.3	1111	56	72.6
2016	Ground	14028	16	19.3	2130	41	54.0
	Air	650	31	34.2	1257	62	75.5
2017	Ground	16266	16	19.4	2500	43	55.6
	Air	672	31	35.9	1189	63	76.8
2018	Ground	18077	17	19.5	2413	41	56.5
	Air	652	31	34.8	1228	62	74.3
2019	Ground	19774	17	19.8	3029	41	54.0
	Air	632	30	33.9	1142	61	73.4

Table 23: Transport Time by EMS Transport Type

Time to Care

Time from EMS Unit Notification to Ambulance Scene Departure by Destination Facility Level

TIME FROM NOTIFICATION TO SCENE DEPARTURE	ANY TRAUMA CENTER	LEVEL III & HIGHER	LEVEL II & HIGHER
<=30 MINUTES	64	64	66
30-45 MINUTES	28	28	26
45-60 MINUTES	5	5	5
>60 MINUTES	3	3	3

Table 23: Time from EMS Unit Notification to Ambulance Scene Departure by Destination Facility Level, 2019

Transport Time to Initial Facility by Facility Level

TRANSPORT TIME TO INITIAL FACILITY	ANY TRAUMA CENTER	LEVEL III & HIGHER	LEVEL II & HIGHER
<=30 MINUTES	65	63	59
30-45 MINUTES	9	10	10
45-60 MINUTES	2	3	3
>60 MINUTES	24	25	28

Table 24: Transport Time to Initial Facility by Facility Level, 2019

Time from Notification to First Facility by Destination Facility Level

TIME TO FIRST FACILITY	ANY TRAUMA CENTER	LEVEL III & HIGHER	LEVEL II & HIGHER
<=60 MINUTES	64	61	55
60-75 MINUTES	9	9	9
75-90 MINUTES	7	7	9
>90 MINUTES	20	22	27

Table25: Time from Notification to First Facility by Destination Facility Level, 2019

Emergency Department Length of Stay (Hours) at Initial Facility

INJURY SEVERITY SCORE	REGION	N OBS	MEAN	MEDIAN	LOWER QUARTILE	UPPER QUARTILE
ISS <=15	Central	818	4.3	3.8	2.8	5.1
	North	617	4.3	3.9	2.9	5.3
	North Central	298	3.7	3.4	2.4	4.7
	Northwest	314	4.4	4	2.8	5.4
	South Central	354	3.9	3.5	2.5	4.6
	Southwest	113	3.9	3.3	2.3	4.9
	East	465	3.6	3.2	2.3	4.5
	West	895	4.6	4	3	5.5
	State	3874	4.2	3.7	2.7	5.1
ISS >=16	Central	131	4	3.5	2.6	5.1
	North	181	3.5	3	2.2	4.3
	North Central	32	3.9	2.8	2.1	4
	Northwest	84	3.6	3.4	2.5	4.4
	South Central	125	3.4	2.9	2.3	4.1
	Southwest	46	2.4	2.3	1.9	3
	East	72	3.6	3.3	2.3	4.6
	West	180	3.9	3.5	2.5	4.9
	State	851	3.6	3.2	2.3	4.4

Table 26: Emergency Department Length of Stay (Hours) at Initial Facility, Patients Transferred to Higher Level of Care by ISS & Region, 2019

Average Time (minutes) to Definitive Trauma Facility by ISS

INJURY SEVERITY SCORE	AVG. TIME (MINUTES) TO DEFINITIVE FACILITY
ISS ≤ 16	80
ISS≥16	124

Table 27: Average Time (minutes) to Definitive Trauma Facility by ISS, 2019

Average Time to Definitive Facility by Facility Level of Care

LEVEL OF DEFINITIVE CARE	AVG. TIME (MINUTES) TO DEFINITIVE FACILITY
LEVEL 1	163
LEVEL 2	95
LEVEL 3	59
LEVEL 4	53
LEVEL 5	47

Table 28: Average Time to Definitive Facility by Facility Level of Care, 2019

Average Time to Definitive Facility by Patient Transfer Status

PATIENT TRANSFERRED TO	N OBS	AVG. TIME (MINUTES) TO DEFINITIVE FACILITY
TRANSFERRED OUT (IN REGION)	2,418	227
TRANSFERRED OUT (OUT OF REGION)	3,130	259
TRANSFERRED OUT (UNKNOWN)	357	66
ADMITTED (NO TRANSFERS)	21,816	63
TRANSFERRED IN (IN REGION)	2,398	309
TRANSFERRED IN (OUT OF REGION)	3,796	344
TRANSFERRED IN (UNKNOWN)	75	247

Table 29: Average Time to Definitive Facility by Patient Transfer Status, 2019

Average EMS Times (minutes) by County

INITIAL RESPONSE COUNTY	NOTIFIED TO DEPARTURE TIME	TIME TO FIRST FACILITY	TIME TO DEFINITIVE FACILITY	TRANSPORT TIME
ADAMS	26.8	59.1	195.9	33.9
ASOTIN	24.2	36.0	62.5	9.3
BENTON	26.5	44.9	74.8	20.8
CHELAN	36.9	58.2	89.6	24.4
CLALLAM	32.0	59.9	124.3	29.6
CLARK	27.3	72.0	72.7	44.8
COLUMBIA	43.4	89.3	151.5	45.9
COWLITZ	27.2	67.4	93.2	41.2
DOUGLAS	25.0	43.3	85.1	18.3
FERRY	64.3	83.0	284.6	18.7
FRANKLIN	28.1	57.4	90.6	27.3
GARFIELD	30.4	45.7	94.1	15.3
GRANT	37.7	62.8	115.0	28.1
GRAYS HARBOR	31.5	52.4	107.7	22.4
ISLAND	31.2	63.7	101.0	31.9
JEFFERSON	43.4	84.4	130.7	41.0
KING	28.3	54.8	79.5	30.6
KITSAP	28.3	54.9	105.9	26.8
KITTITAS	52.8	102.9	102.9	50.1
KLICKITAT	36.2	53.4	72.7	19.6
LEWIS	29.8	54.3	137.2	24.4
LINCOLN	49.5	82.0	106.5	31.6
MASON	40.0	70.3	121.2	28.9
OKANOGAN	51.2	99.3	192.3	44.1
PACIFIC	26.1	55.4	67.2	29.3
PEND OREILLE	43.7	90.3	133.5	48.1
PIERCE	27.3	66.6	92.3	39.4
SAN JUAN	49.6	86.3	130.8	38.7
SKAGIT	28.1	44.0	84.9	16.8
SKAMANIA	28.5	79.5	79.5	51.0
SNOHOMISH	25.0	48.1	69.6	23.3
SPOKANE	32.2	79.0	84.7	47.5
STEVENS	45.2	89.7	124.0	44.7
THURSTON	26.0	54.2	85.0	28.4
WAHKIAKUM	78.0	98.7	111.8	46.8
WALLA WALLA	30.3	37.7	135.1	10.9
WHATCOM	28.8	45.9	66.2	19.0
WHITMAN	36.7	57.4	104.0	21.1
YAKIMA	30.2	59.9	108.4	30.3

Table 30: Average Times (minutes) by County, 2019

Outcomes

Risk-adjusted mortality odds ratio, level I&II trauma centers

FACILITY	ODDS RATIO	95% CONFIDENCE INTERVAL
A	0.73	0.56, 0.94
B	0.82	0.6, 1.11
C	0.96	0.73, 1.25
D	1.05	0.8, 1.38
E	1.11	0.74, 1.67
F	1.11	0.86, 1.43
G	1.13	0.83, 1.53
H	1.25	0.95, 1.63

Table 31, Risk-adjusted mortality odds ratio, level I&II trauma centers, WA 2019

Risk-adjusted mortality odds ratio, level III trauma centers

FACILITY	ODDS RATIO	95% CONFIDENCE INTERVAL
A	0.63	0.36, 1.11
B	0.7	0.43, 1.16
C	0.78	0.39, 1.55
D	0.79	0.51, 1.23
E	0.88	0.47, 1.67
F	0.88	0.43, 1.79
G	0.89	0.57, 1.39
H	0.92	0.47, 1.8
I	0.92	0.54, 1.54
J	0.93	0.6, 1.45
K	0.94	0.56, 1.57
L	0.96	0.58, 1.6
M	0.99	0.59, 1.69
N	1.05	0.52, 2.12
O	1.05	0.64, 1.7
P	1.06	0.72, 1.56
Q	1.1	0.54, 2.04
R	1.12	0.7, 1.81
S	1.13	0.71, 1.82
T	1.15	0.65, 2.04
U	1.43	0.87, 2.35
V	1.8	0.84, 3.86
W	2.11	1.1, 4.04

Table 32, Risk-adjusted mortality odds ratio, level III trauma centers, WA 2019

Risk-adjusted mortality odds ratio, level IV&V trauma centers

FACILITY	ODDS RATIO	95% CONFIDENCE INTERVAL
1	0.51	0.16, 1.64
2	0.75	0.26, 2.19
3	0.76	0.26, 2.21
4	0.77	0.26, 2.25
5	0.77	0.27, 2.23
6	0.82	0.27, 2.48
7	0.87	0.29, 2.59
8	0.88	0.29, 2.61
9	0.91	0.35, 2.33
10	0.92	0.30, 2.76
11	0.92	0.30, 2.82
12	0.92	0.31, 2.79
13	0.95	0.31, 2.88
14	0.96	0.31, 2.96
15	0.96	0.31, 2.96
16	0.96	0.31, 2.96
17	0.97	0.45, 2.12
18	0.98	0.45, 2.10
19	0.98	0.32, 3.02
20	0.98	0.32, 3.03
21	0.98	0.32, 3.03
22	0.98	0.32, 3.04
23	0.98	0.32, 3.05
24	0.99	0.32, 3.06
25	0.99	0.32, 3.07
26	0.99	0.32, 3.07
27	0.99	0.32, 3.08
28	0.99	0.32, 3.06
29	1.00	0.32, 3.11
30	1.00	0.32, 3.11
31	1.00	0.32, 3.12
32	1.00	0.32, 3.12
33	1.00	0.32, 3.13
34	1.05	0.38, 2.9
35	1.06	0.52, 2.16
36	1.09	0.38, 3.1
37	1.11	0.36, 3.43
38	1.13	0.39, 3.3
39	1.14	0.53, 2.48
40	1.31	0.39, 4.4
41	1.34	0.49, 3.63

42	1.37	0.39, 4.86
43	1.80	0.4, 8.13
44	2.08	0.84, 5.1
45	2.24	0.97, 5.17

Table 33, Risk-adjusted mortality odds ratio, level IV&V trauma centers, WA 2019

Trauma Registry In-hospital Mortality Distribution

	MALE		FEMALE	
AGE-GROUP	***Death Counts***	***Death %***	***Death Counts***	***Death %***
0-4	11	2%	9	2%
5-9	1	0%	6	1%
10-14	8	1%	5	1%
15-19	19	3%	6	1%
20-24	33	5%	4	1%
25-29	33	5%	7	2%
30-34	33	5%	9	2%
35-39	28	4%	10	2%
40-44	22	3%	3	1%
45-49	37	5%	6	1%
50-54	20	3%	8	2%
55-59	34	5%	16	4%
60-64	41	6%	21	5%
65-69	51	7%	31	8%
70-74	52	8%	29	7%
75-79	73	11%	46	11%
80-84	65	9%	45	11%
85+	124	18%	140	35%

Table 34: Trauma Registry In-hospital Mortality Distribution, 2019

Crude & Age-adjusted In-hospital Mortality Rates

YEAR	DEATH COUNT	ALL PATIENTS	CRUDE RATE/100 POPULATIONS	STANDARDIZED RATE/100 POPULATIO	STANDARD ERROR	LOWER CL	UPPER CL	CRUDE LL	CRUDE UL
1995	429	5,412	7.9268	7.3791	0.3837	6.627	8.1312	7.2	8.7
1996	486	6,929	7.014	6.47	0.3231	5.8367	7.1033	6.4	7.6
1997	608	7,804	7.7909	7.3984	0.3321	6.7475	8.0493	7.2	8.4
1998	565	8,435	6.6983	6.0783	0.2795	5.5305	6.6261	6.1	7.3
1999	587	9,075	6.4683	5.7068	0.2574	5.2023	6.2113	5.9	7
2000	628	11,528	5.4476	4.6905	0.2077	4.2834	5.0976	5	5.9
2001	672	13,149	5.1107	4.295	0.1847	3.933	4.657	4.7	5.5
2002	679	13,888	4.8891	4.1481	0.1753	3.8046	4.4916	4.5	5.3
2003	670	14,864	4.5075	3.7666	0.1609	3.4513	4.082	4.2	4.8
2004	702	15,940	4.404	3.6121	0.1531	3.312	3.9122	4.1	4.7
2005	657	17,309	3.7957	3.1189	0.1384	2.8476	3.3901	3.5	4.1
2006	722	19,477	3.7069	2.9302	0.124	2.6871	3.1733	3.4	4
2007	716	19,067	3.7552	2.9728	0.1264	2.7252	3.2205	3.5	4
2008	723	18,679	3.8707	2.9902	0.1287	2.7379	3.2424	3.6	4.2
2009	740	20,174	3.6681	2.88	0.1238	2.6375	3.1226	3.4	3.9
2010	734	19,862	3.6955	2.8783	0.1255	2.6323	3.1244	3.4	4
2011	764	21,356	3.5774	2.831	0.1228	2.5904	3.0716	3.3	3.8
2012	790	21,955	3.5983	2.7788	0.1184	2.5468	3.0108	3.3	3.8
2013	793	23,520	3.3716	2.7234	0.1191	2.4899	2.9569	3.1	3.6
2014	863	25,921	3.3293	2.5751	0.1099	2.3597	2.7906	3.1	3.6
2015	909	27,629	3.29	2.5859	0.1064	2.3774	2.7944	3.1	3.5
2016	945	29,149	3.242	2.3836	0.0971	2.1933	2.574	3	3.4
2017	1,019	30,787	3.3098	2.4365	0.0985	2.2433	2.6296	3.1	3.5
2018	1,050	32,774	3.2038	2.3907	0.1003	2.1941	2.5872	3	3.4
2019	1,086	34,658	3.1335	2.3141	0.0983	2.1215	2.5066	2.9	3.3

Table 35: Crude & Age-adjusted In-hospital Mortality Rates, WA Trauma Registry

Crude & Age-adjusted In-hospital Mortality Rates by Sex

YEAR	SEX	DEATH COUNTS	ALL PATIENTS	CRUDE RATE/1000 POPULATIONS	STANDARDIZED RATE/1000 POPULATIONS	STANDARD ERROR	LOWER CL	UPPER CL	CRUDE LL	CRUDE UL
1995	Male	295	3,483	847	827.8	50.9793	727.9	927.7	750.3	943.6
	Female	134	1,929	694.7	629.8	64.8691	502.6	756.9	577	812.3
1996	Male	325	4,257	763.4	715.4	42.0905	632.9	797.9	680.4	846.5
	Female	161	2,672	602.5	607.6	57.1832	495.5	719.6	509.5	695.6
1997	Male	406	4,819	842.5	789	41.8207	707	871	760.5	924.5
	Female	202	2,985	676.7	707.5	59.8086	590.3	824.8	583.4	770
1998	Male	393	5,277	744.7	681.3	35.9932	610.7	751.8	671.1	818.4
	Female	172	3,158	544.6	522.8	48.1097	428.5	617.1	463.3	626
1999	Male	390	5,698	684.5	632	33.4124	566.5	697.5	616.5	752.4
	Female	197	3,377	583.4	518.2	44.741	430.5	605.9	501.9	664.8
2000	Male	414	7,199	575.1	540.7	28.105	485.6	595.8	519.7	630.5
	Female	214	4,329	494.3	381.2	33.3283	315.9	446.5	428.1	560.6
2001	Male	409	8,080	506.2	467.8	24.2206	420.3	515.3	457.1	555.2
	Female	263	5,069	518.8	409.8	32.0667	347	472.7	456.1	581.5
2002	Male	466	8,784	530.5	482.2	23.5426	436	528.3	482.3	578.7
	Female	213	5,104	417.3	326.4	27.6838	272.1	380.6	361.3	473.4
2003	Male	447	9,177	487.1	448.2	22.1202	404.9	491.6	441.9	532.2
	Female	223	5,687	392.1	278.5	23.8885	231.7	325.3	340.7	443.6
2004	Male	484	9,865	490.6	427.2	20.6814	386.7	467.7	446.9	534.3
	Female	218	6,075	358.8	282.4	24.7616	233.9	330.9	311.2	406.5
2005	Male	462	10,615	435.2	389.1	19.316	351.3	427	395.5	474.9
	Female	195	6,694	291.3	192.6	18.912	155.5	229.7	250.4	332.2
2006	Male	485	12,184	398.1	356.2	17.1399	322.6	389.8	362.6	433.5
	Female	237	7,293	325	201.9	18.2041	166.2	237.6	283.6	366.3
2007	Male	480	12,142	395.3	345.2	16.7903	312.3	378.1	360	430.7
	Female	236	6,925	340.8	225.3	20.1449	185.8	264.8	297.3	384.3
2008	Male	481	11,519	417.6	355.5	17.3921	321.4	389.6	380.3	454.9
	Female	242	7,160	338	222	20.512	181.8	262.2	295.4	380.6
2009	Male	472	12,185	387.4	322.1	16.0185	290.7	353.5	352.4	422.3
	Female	268	7,989	335.5	256.3	21.2902	214.6	298	295.3	375.6
2010	Male	495	11,832	418.4	346.2	16.774	313.3	379	381.5	455.2
	Female	239	8,030	297.6	216.3	20.6959	175.7	256.9	259.9	335.4
2011	Male	512	12,582	406.9	343.4	16.6654	310.8	376.1	371.7	442.2
	Female	252	8,774	287.2	206.5	18.7977	169.6	243.3	251.8	322.7
2012	Male	511	13,054	391.5	322.5	15.5663	292	353	357.5	425.4
	Female	279	8,901	313.4	204.8	17.8269	169.9	239.8	276.7	350.2
2013	Male	546	13,702	398.5	329.3	15.9774	298	360.6	365.1	431.9
	Female	247	9,818	251.6	187.3	17.4545	153.1	221.5	220.2	283

2014	Male	571	14,984	381.1	304.9	14.6427	276.2	333.6	349.8	412.3
	Female	292	10,937	267	183.1	16.0048	151.8	214.5	236.4	297.6
2015	Male	581	15,896	365.5	301.3	14.1251	273.6	329	335.8	395.2
	Female	328	11,733	279.6	197.5	16.4415	165.3	229.7	249.3	309.8
2016	Male	621	16,916	367.1	280.8	12.9836	255.4	306.3	338.2	396
	Female	324	12,233	264.9	182.4	14.9996	153	211.8	236	293.7
2017	Male	691	17,431	396.4	296.6	13.2411	270.7	322.6	366.9	426
	Female	328	13,356	245.6	171.4	14.6199	142.7	200	219	272.2
2018	Male	660	18,484	357.1	273.8	12.9289	248.4	299.1	329.8	384.3
	Female	390	14,290	272.9	186.2	15.8661	155.1	217.3	245.8	300
2019	Male	685	19,255	355.8	264.6	12.494	240.1	289.1	329.1	382.4
	Female	401	15,403	260.3	178	15.5208	147.6	208.4	234.9	285.8

Table 36: Crude & Age-adjusted In-hospital Mortality Rates by Sex, WA Trauma Registry

F. Regional Data Figures and Tables

Included are regional level data figures and tables corresponding to all figures provided in the main body of the Washington Trauma Services Assessment.

Central Region data figures and tables

Projected Percent Change in Population by EMS and Trauma Region

Region	Projected Change 2020-2030
Central	+22%
State	+10%

Figure 1 Population % Change, 2020-2030, EMS & Trauma Region

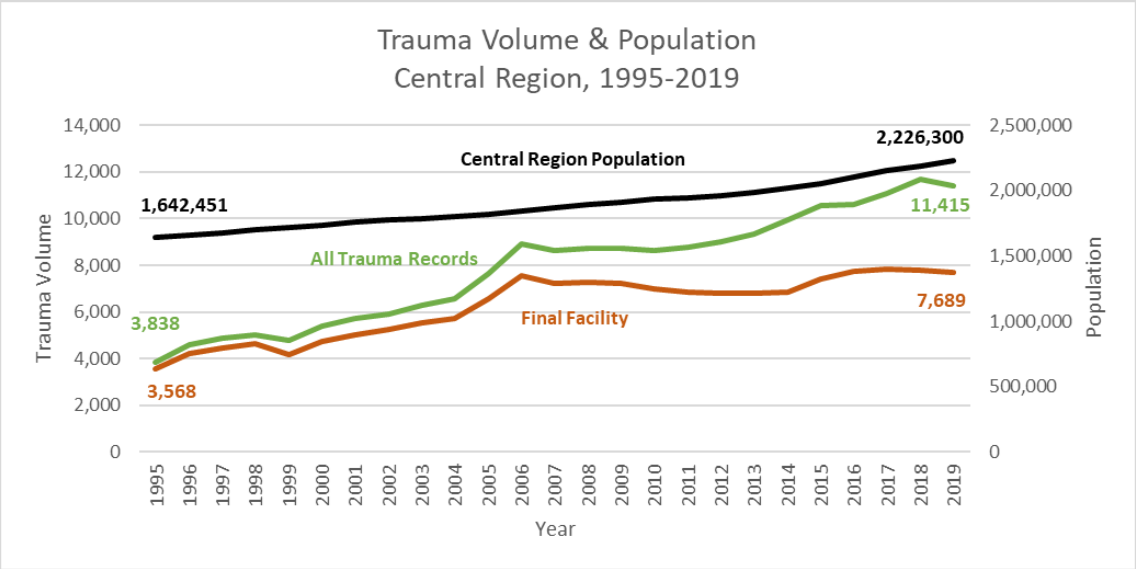

Figure 2 Trauma Volume & Population, Central Region 1995-2019

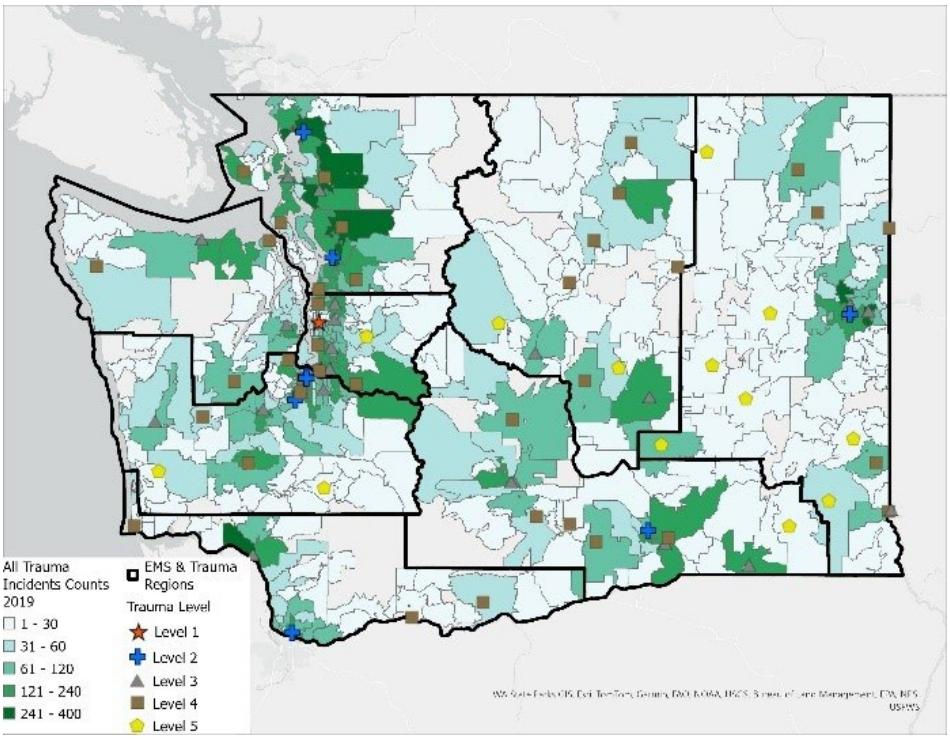

Figure 3 Map of Severe Trauma Distribution by Zip Code, 2019

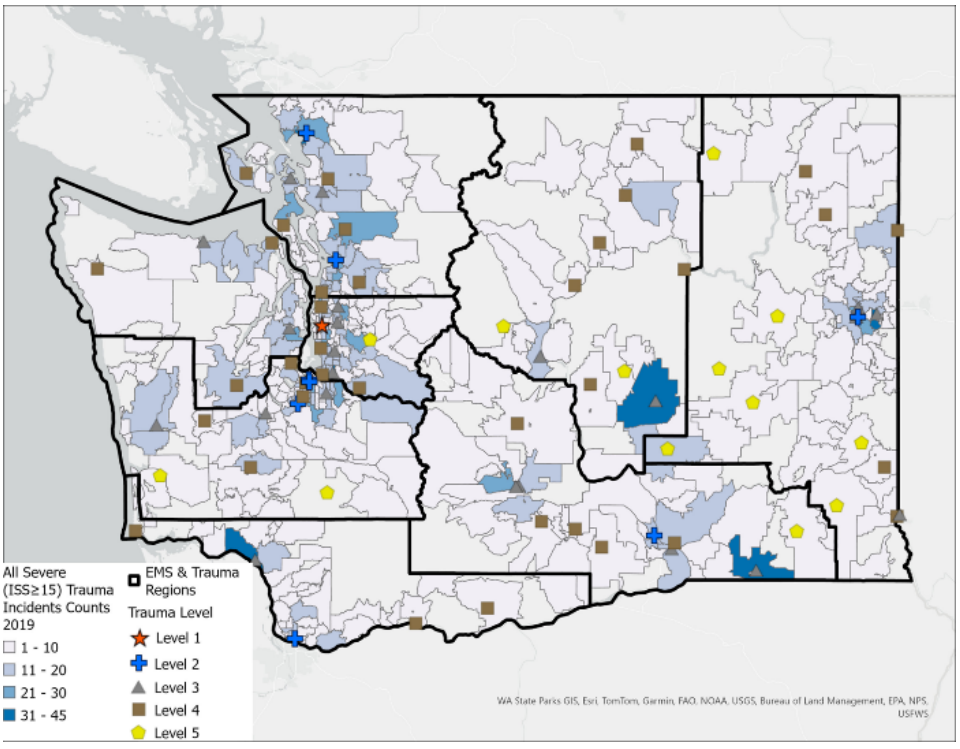

Figure 4 Map of Trauma Distribution by Zip Code, 2019

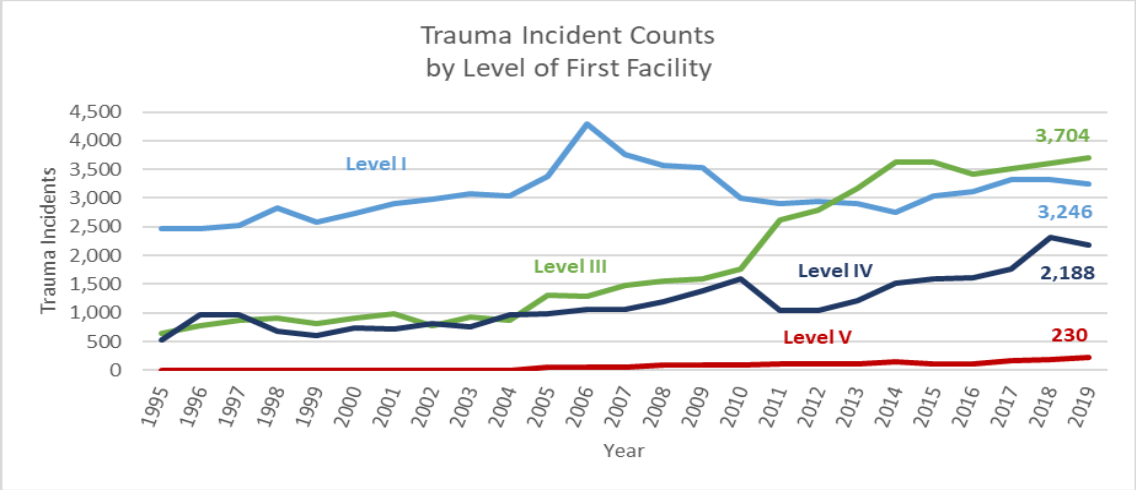

Figure 5 Central Region Trauma Incident Counts by Level of First Facility, 1995-2019

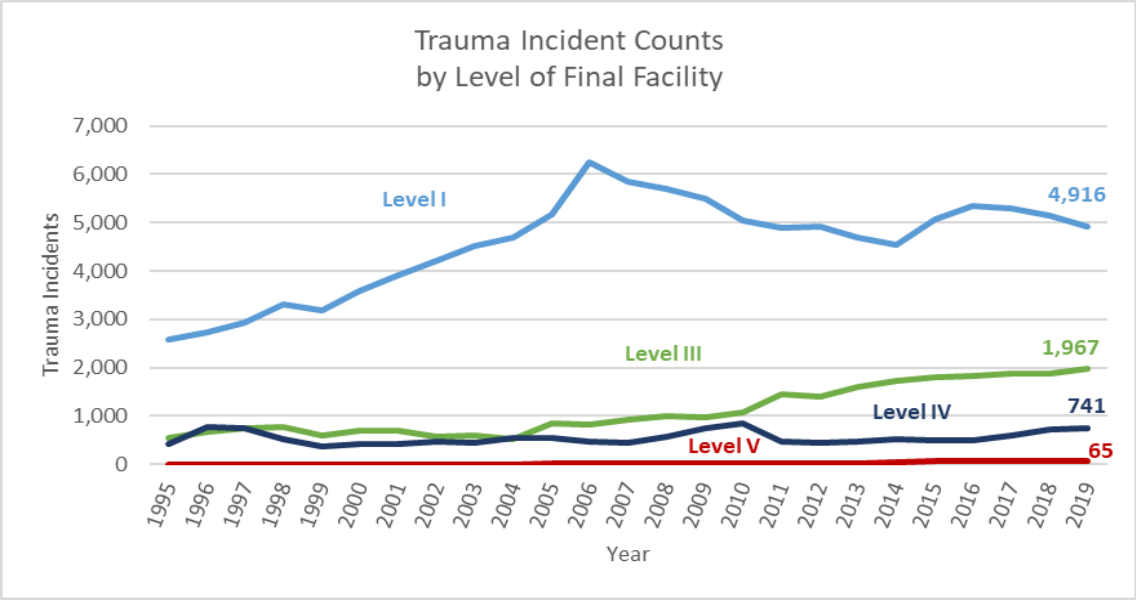

Figure 6 Central Region Trauma Incident Counts by Level of Final Facility, 1995-2019

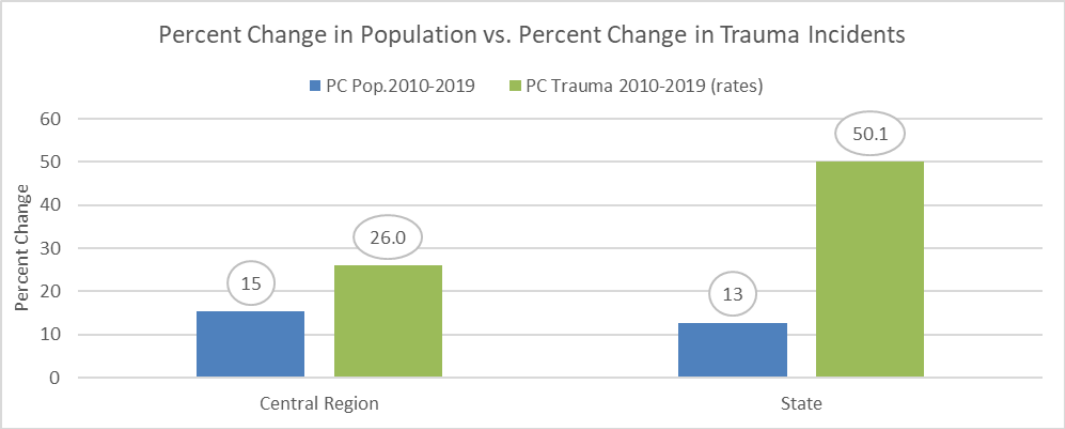

Figure 7 Regional % change in population and trauma incidents, Central Region vs. State

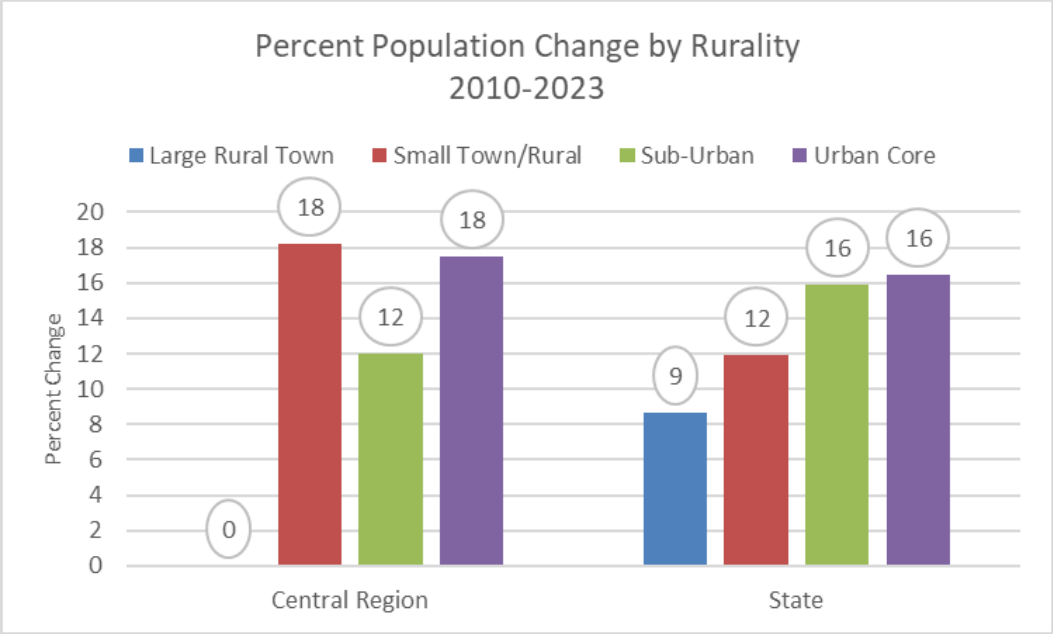

Figure 8 Rurality Population Percent Change, Central Region vs. State, 2010-2023

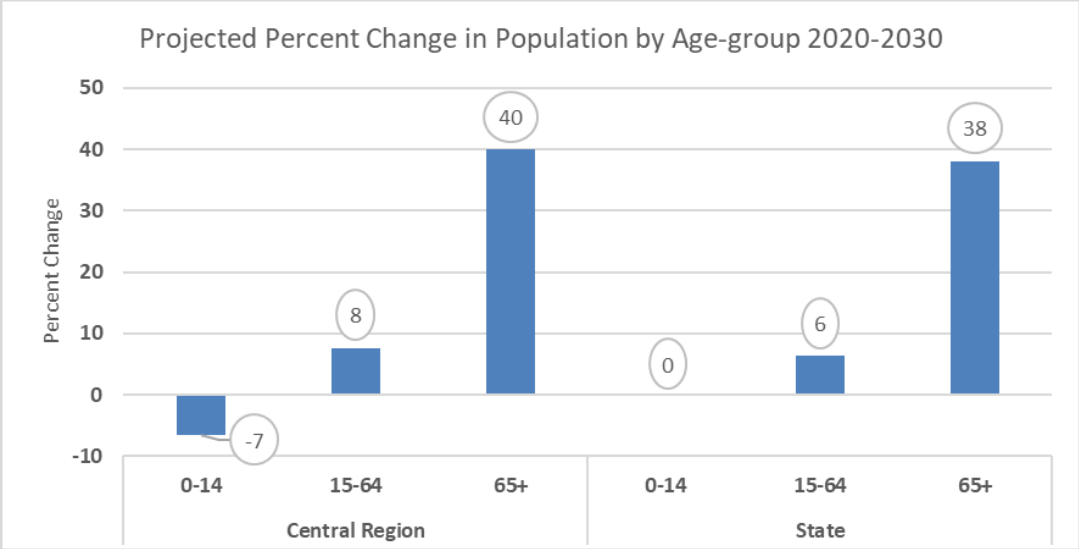

Figure 9 Central Region vs. State projected population growth 2020-2030

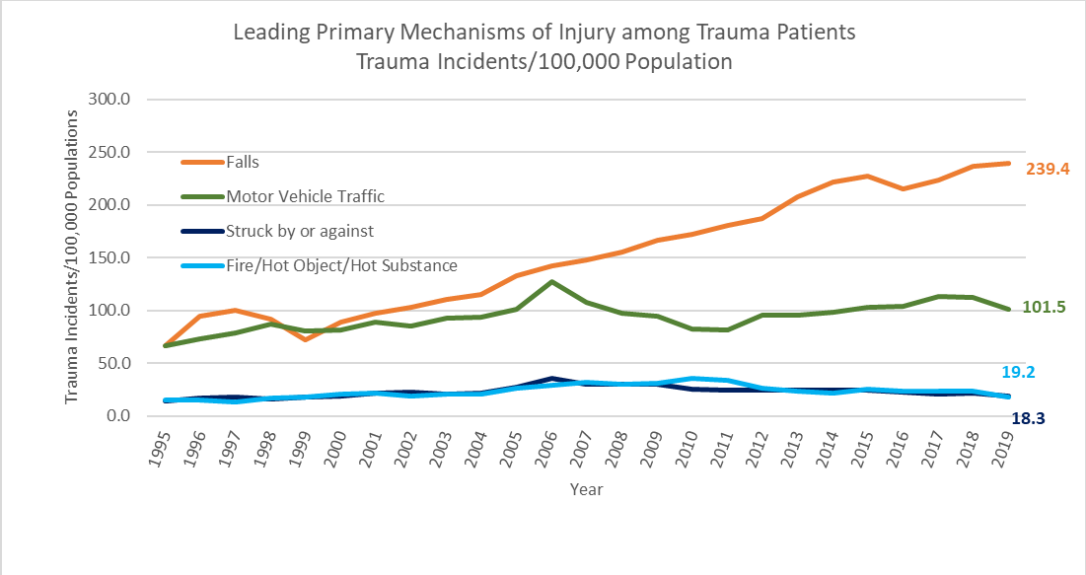

Figure 10 Leading Primary Mechanism of Injury, Central Region,1995-2019

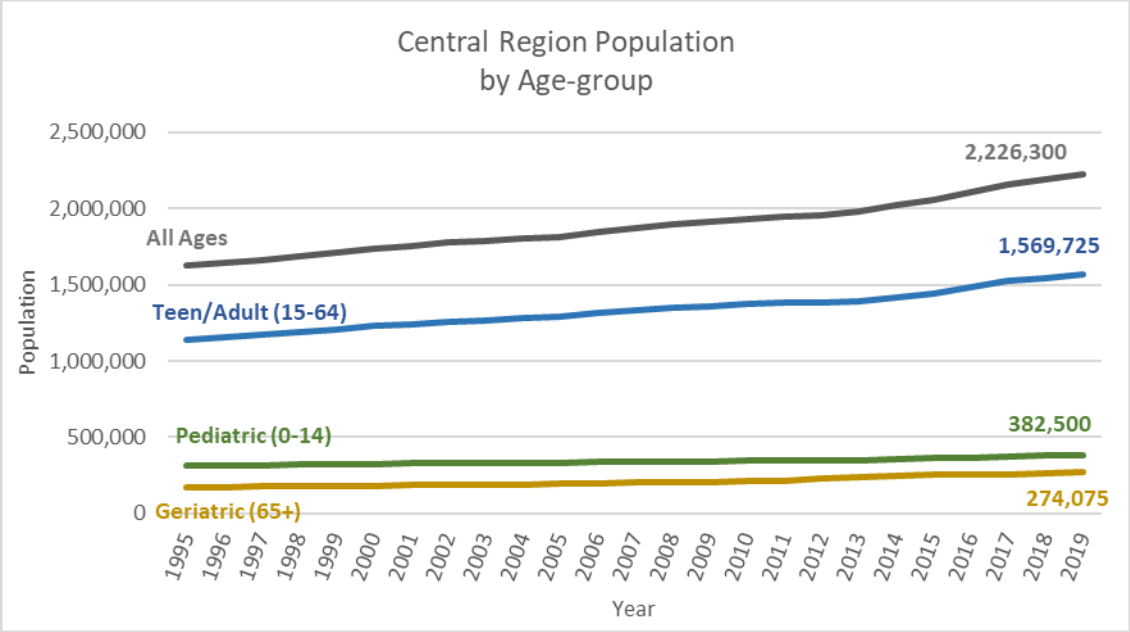

Figure 11 Central Region Population by Age-group, 1995-2019

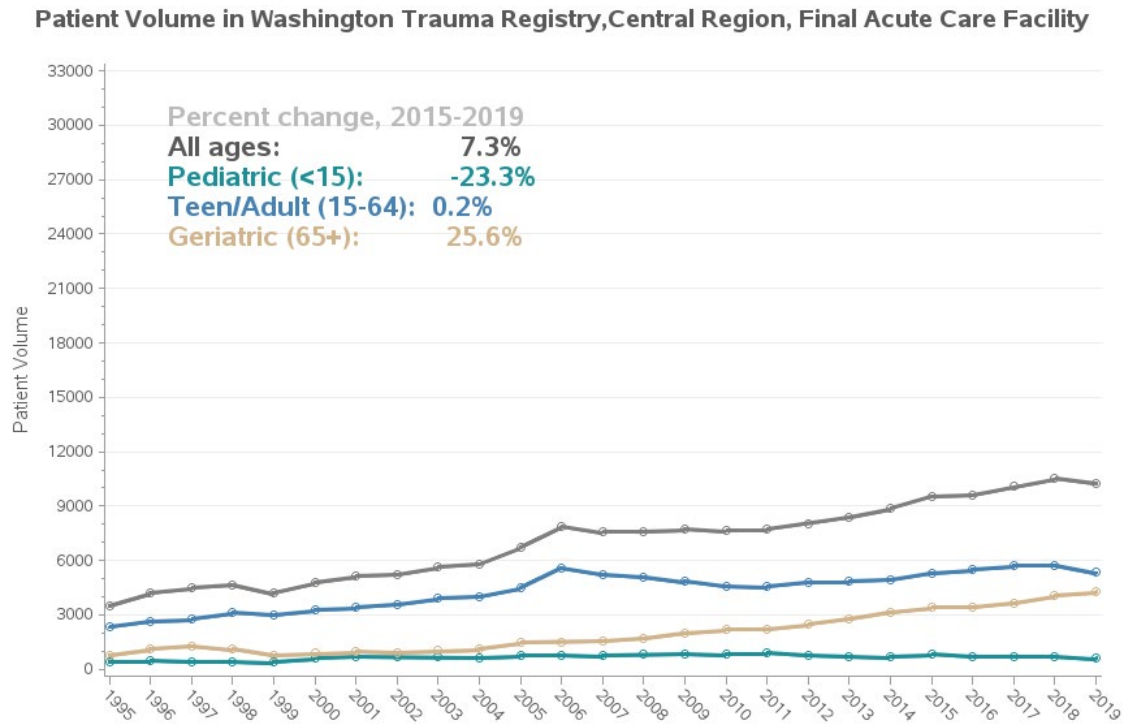

Figure 12 Trauma Volume by Age-group, Central Region

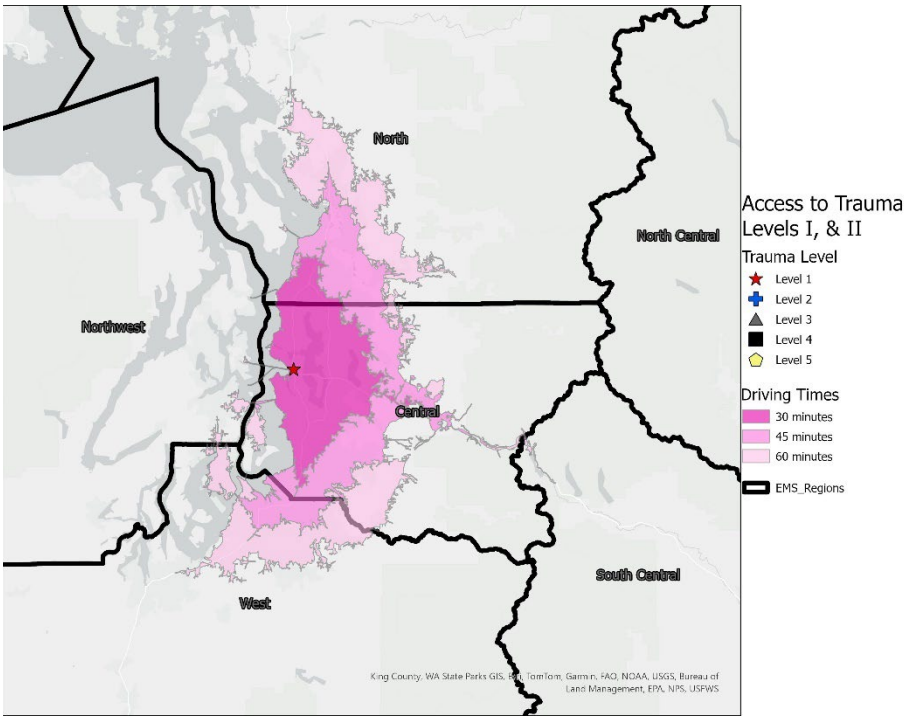

Figure 13 Trauma Levels I &II Driving Times to facilities within Central Region

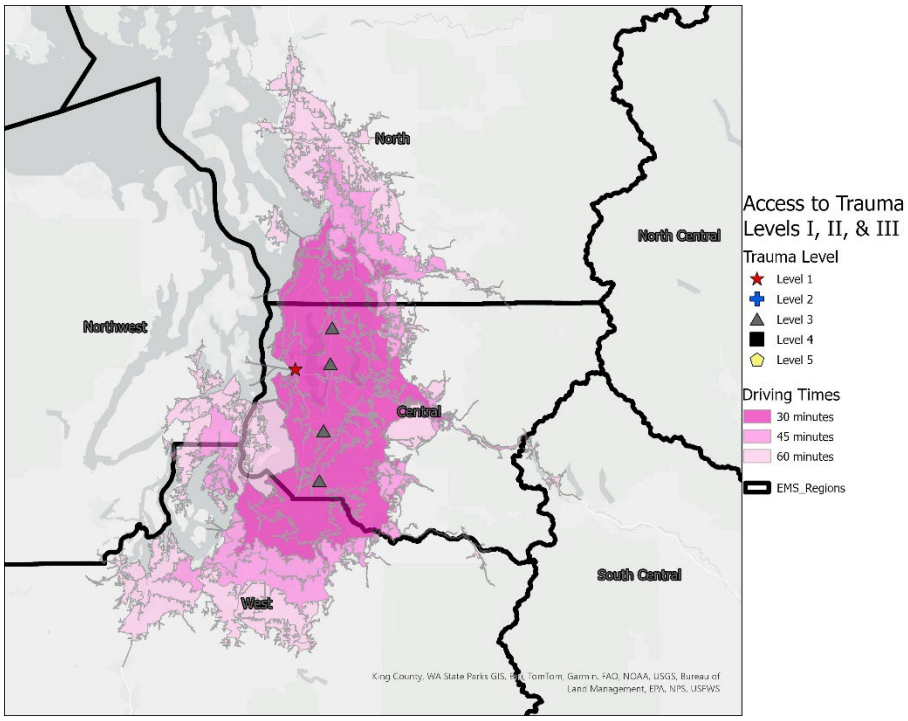

Figure 14 Trauma Levels I, II, & III Driving Times to facilities within Central Region

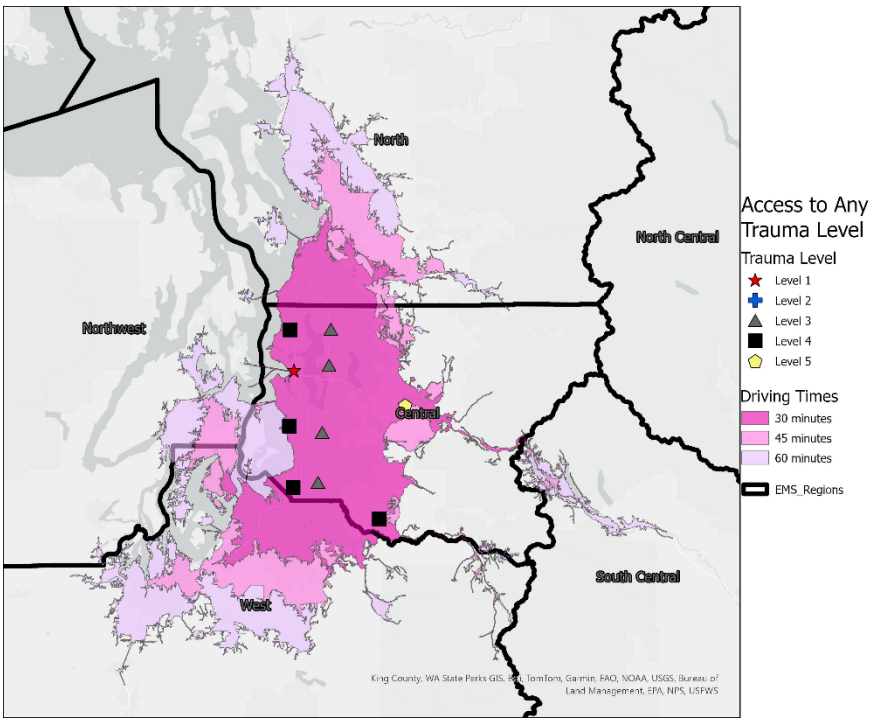

Figure 15 Any Trauma Level Driving Times to facilities within Central Region

Population within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
Central	≤30 min%	85%	98%	99%
	≤45 min%	99%	99%	99%
	≤60 min%	100%	100%	100%

Figure 16 Central Region population within driving distances to trauma center

Percent of trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
Central	≤30 min%	91%	98%	99%
	≤45 min%	98%	99%	100%
	≤60 min%	99%	99%	100%

Figure 17 Central Region trauma incidents within driving distances to trauma centers

Percent of Severe Trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
Central	≤30 min%	90%	98%	99%
	≤45 min%	97%	98%	99%
	≤60 min%	99%	99%	100%

Figure 18 Central Region severe trauma incidents within driving distances to trauma centers

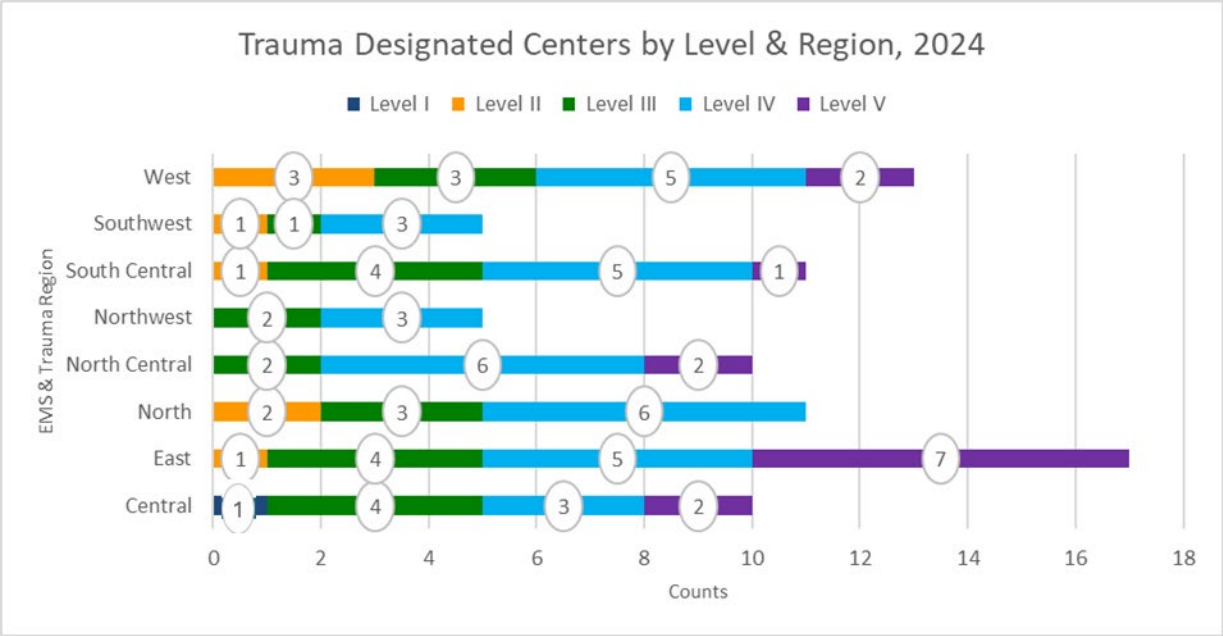

Figure 19 Trauma Designated Centers by Level & Region, 2024

Trauma Patients Initial and Highest Designated Level of Care (%), Central Region, 2019

		Highest Level of Care				
		Level I	**Level II**	**Level III**	**Level IV**	**Level V**
Initial Level of Care	**Level I**	100%	-	-	-	-
	Level II	32%	68%	-	-	-
	Level III	11%	2%	87%	-	-
	Level IV	13%	9%	-	78%	-
	Level V	15%	18%	8%	-	58%

Figure 20 Trauma Patients Initial & Highest Designated Level of Care (%), Central Region, 2019

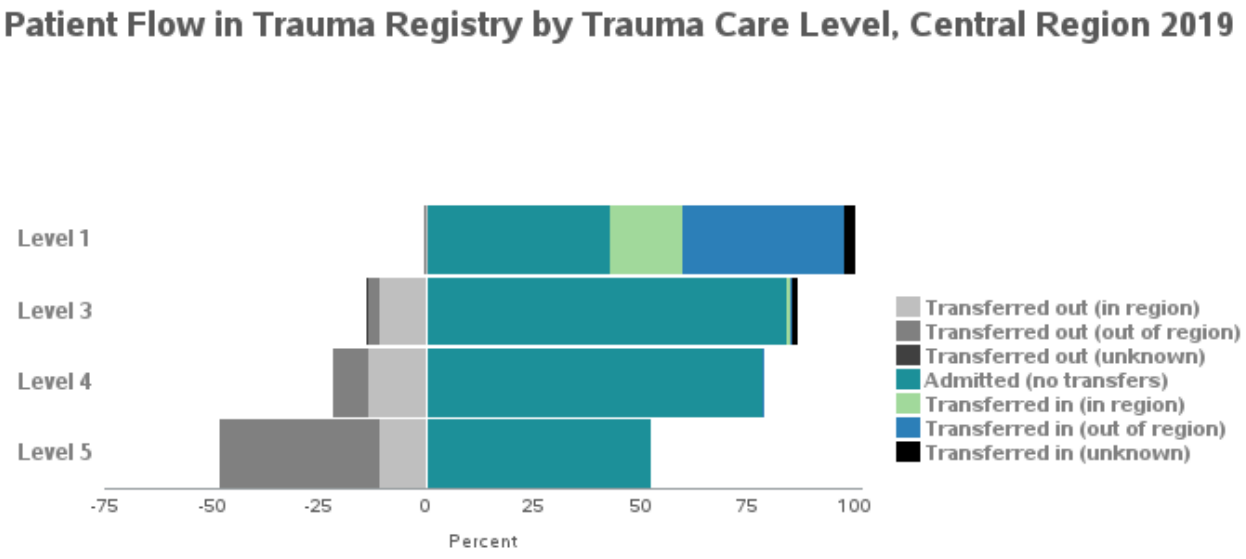

Figure 21 Patient Flow in Trauma Registry by Trauma Level of Care, Central Region 2019

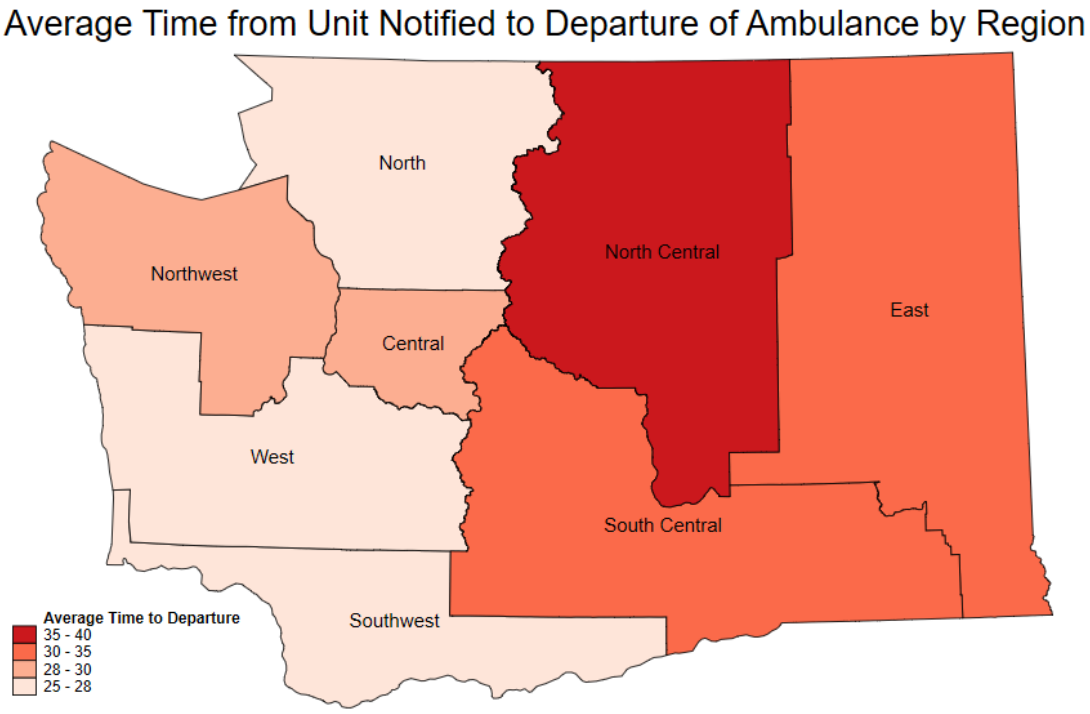

Figure 22 Average Time from EMS Unit Notification to Scene Departure by Region

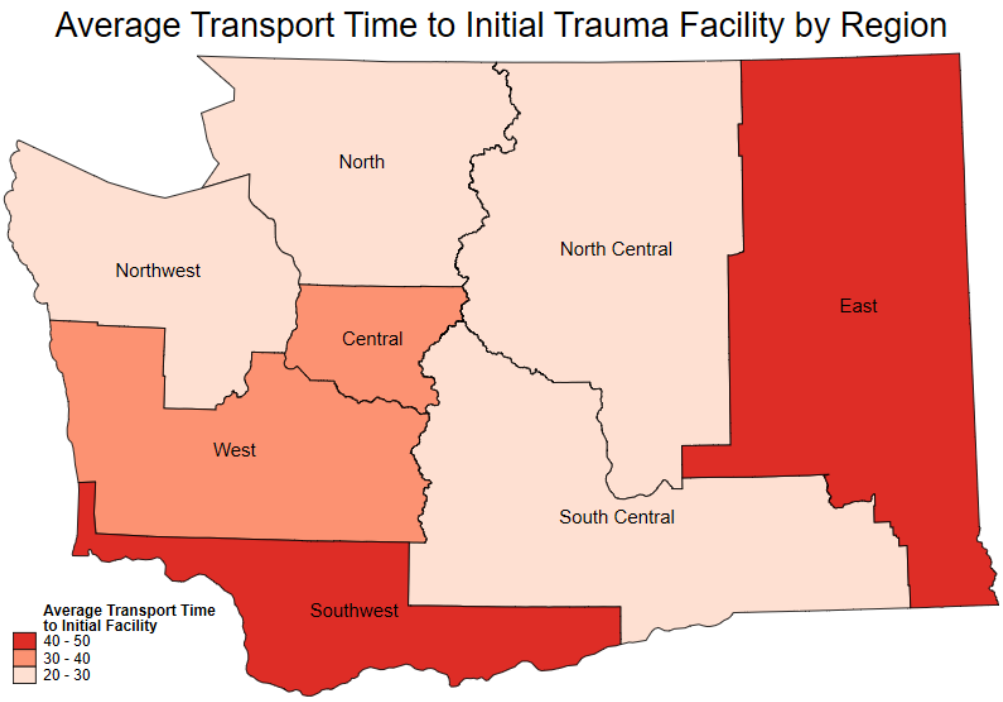

Figure 23 Average Transport Time from Scene Departure to Initial Facility by Region

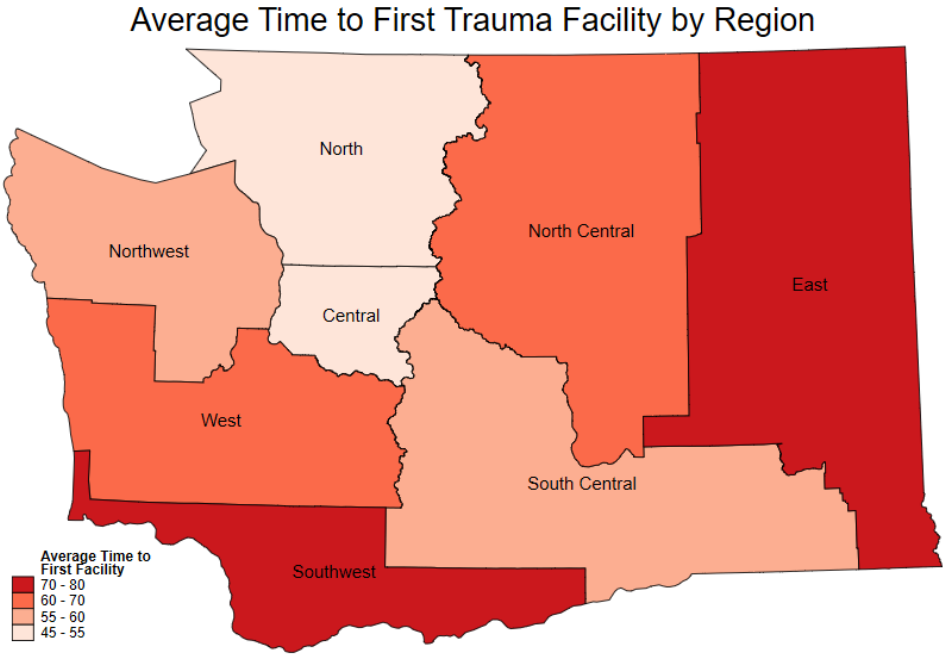

Figure 24 Average Time from EMS Unit Notification to First Trauma Facility by Region

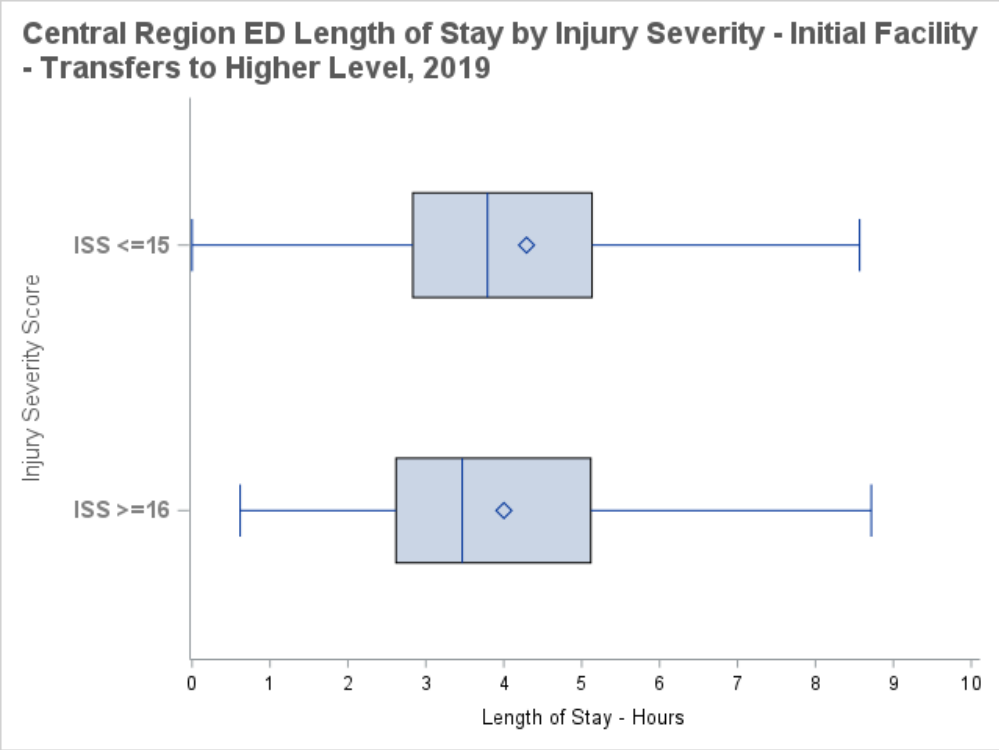

Figure 25 Regional Emergency Department Length of Stay at Initial Facility, Patients Transferred to Higher Level of Care, by ISS

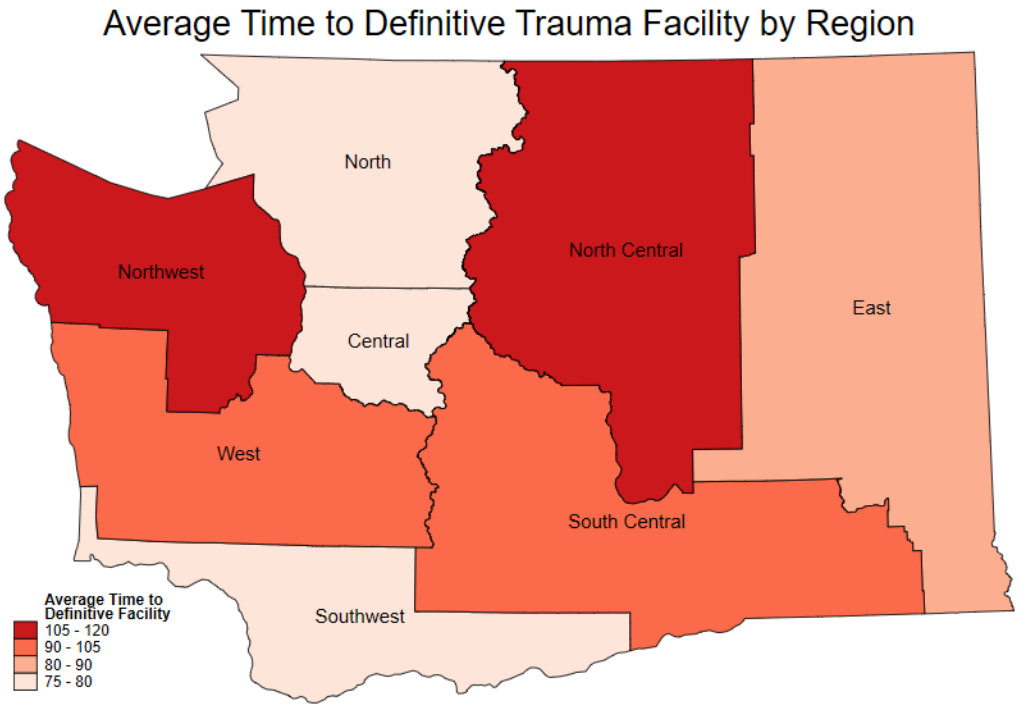

Figure 26 Average Time from EMS Unit Notification to Definitive Trauma Facility by Region

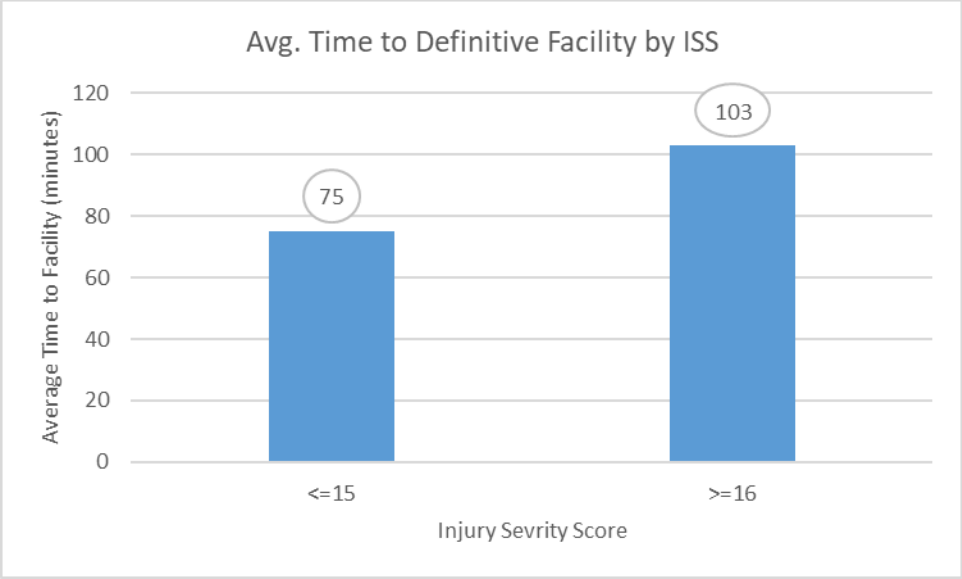

Figure 27 Average Time from EMS Unit Notification to Definitive Trauma Facility by Injury Severity Score, Central Region

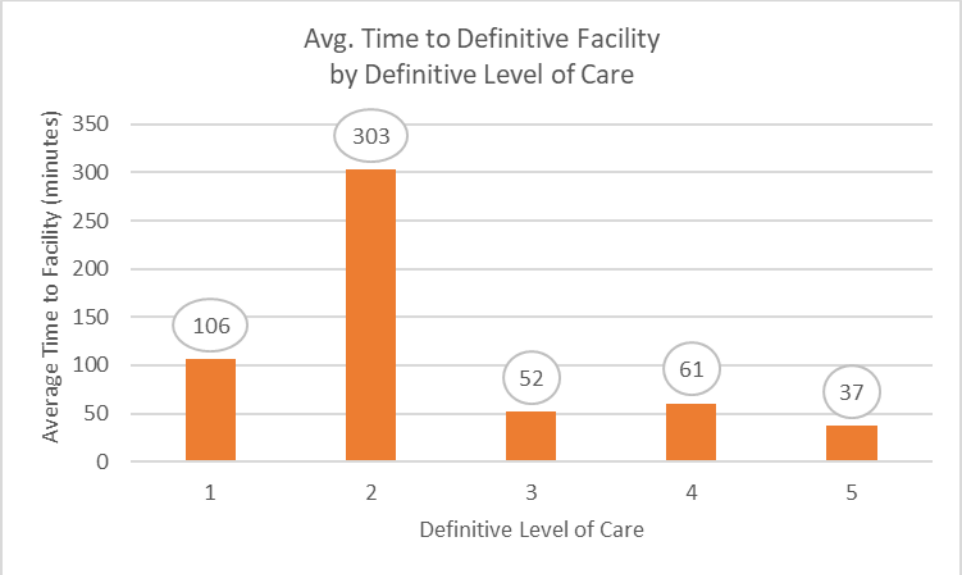

Figure 28 Average Time from EMS Unit Notification to Definitive Care by Level of Definitive Facility, Central Region, 2019

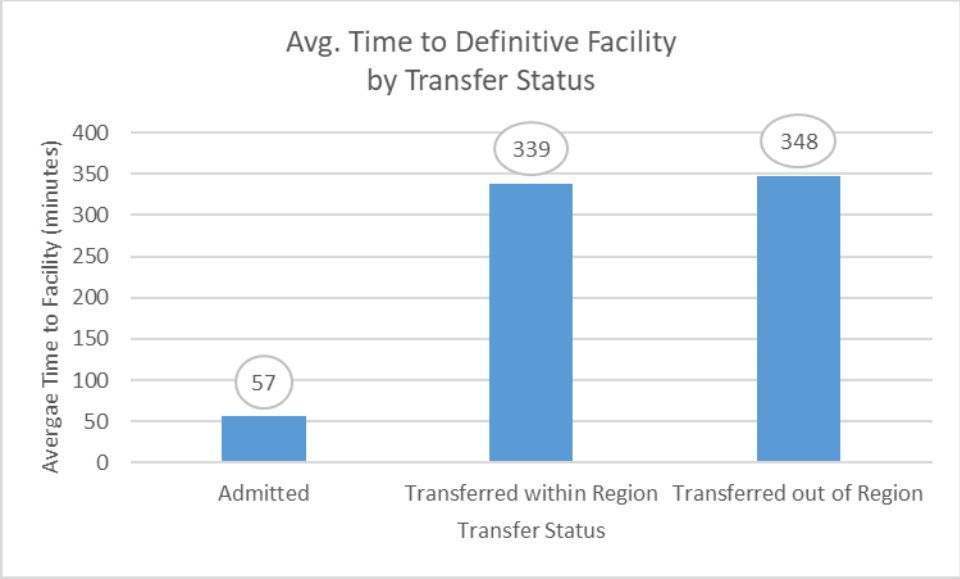

Figure 29 Average Time from EMS Unit Notification to Definitive Facility by Transfer Status, Central Region, 2019

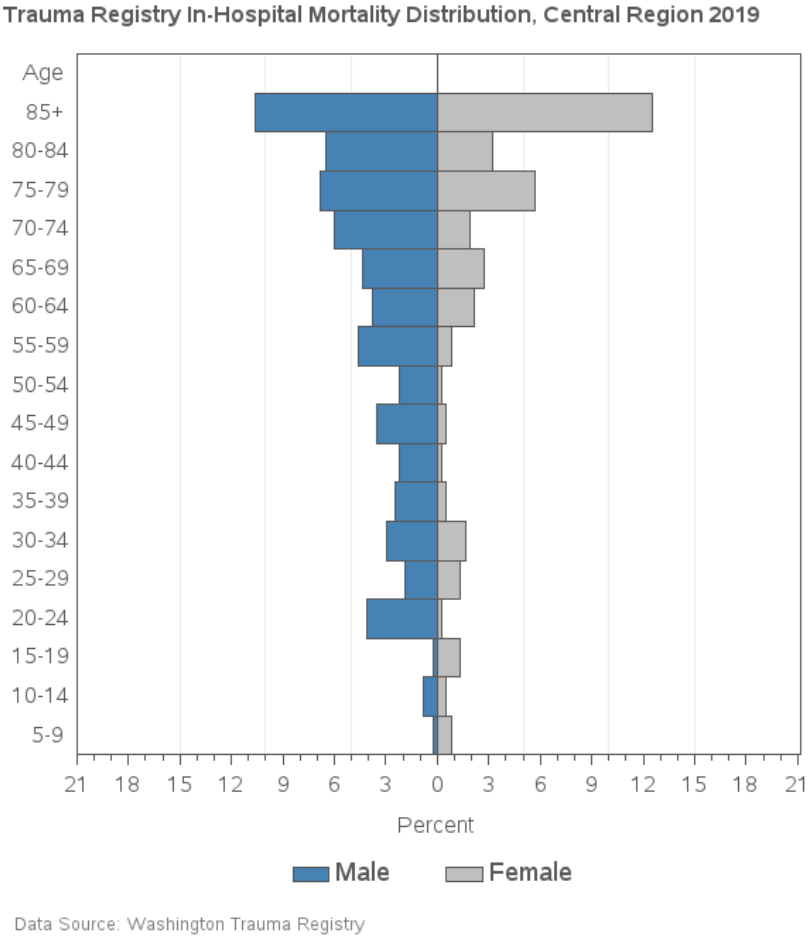

Figure 30 Trauma Registry In-hospital Mortality Distribution, Central Region 2019

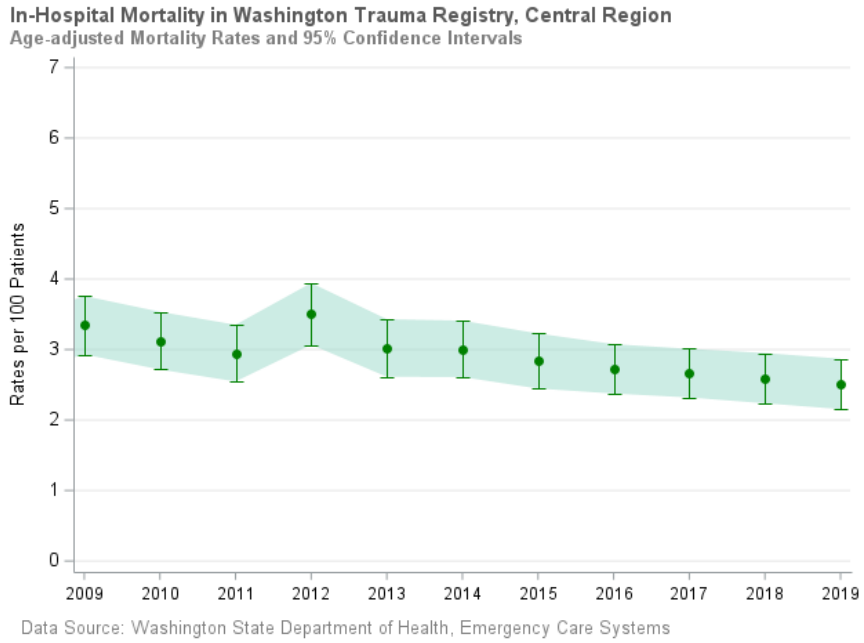

Figure 31 Age-adjusted Mortality Rates in WA Trauma Registry, Central Region, 2019

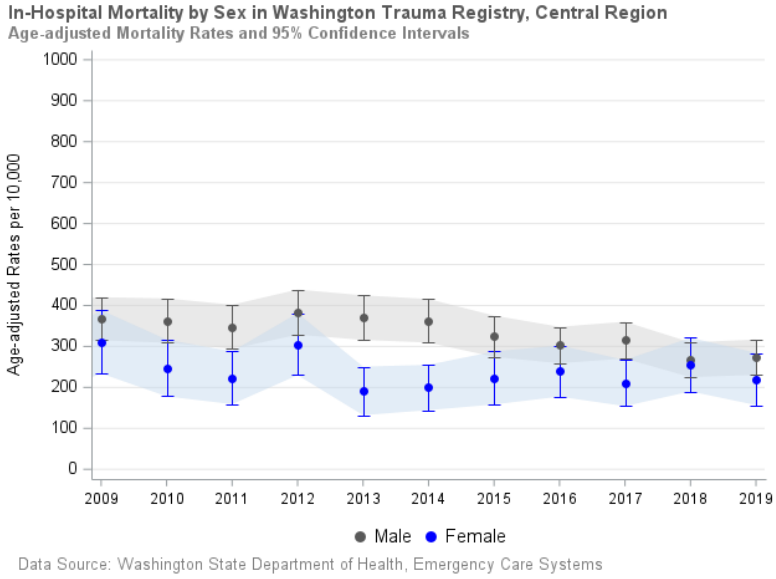

Figure 32 Age-adjusted Mortality Rates by Sex in WA Trauma Registry, Central Region, 2019

East Region data figures and tables

Projected Percent Change in Population by EMS and Trauma Region

Region	Projected Change 2020-2030
East	+15%
State	+10%

Figure 1 Population % Change, 2020-2030, EMS & Trauma Region

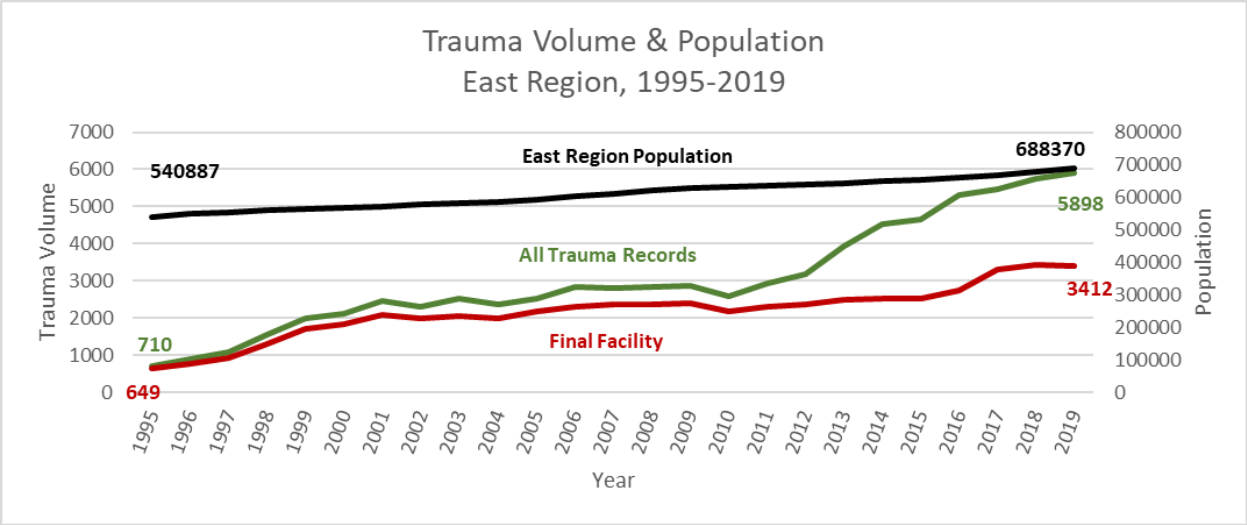

Figure 2 Trauma Volume & Population, East Region 1995-2019

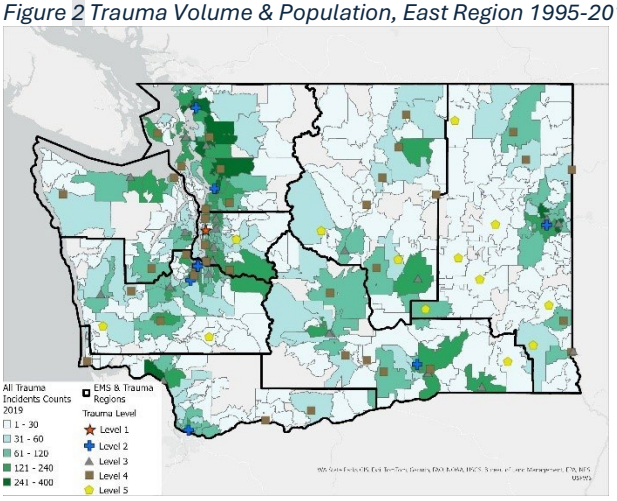

Figure 3 Map of Severe Trauma Distribution by Zip Code, 2019

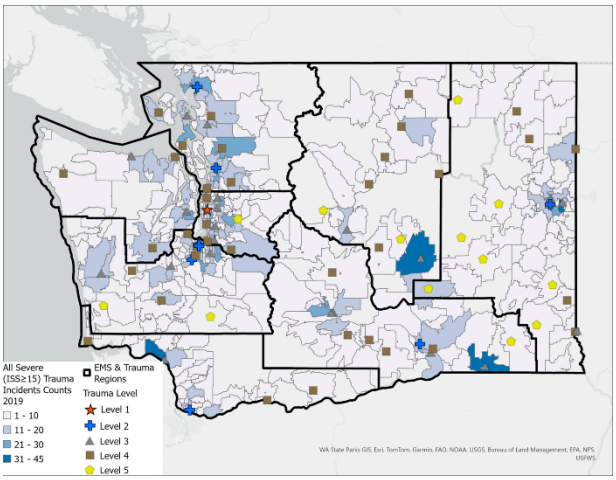

Figure 4 Map of Trauma Distribution by Zip Code, 2019

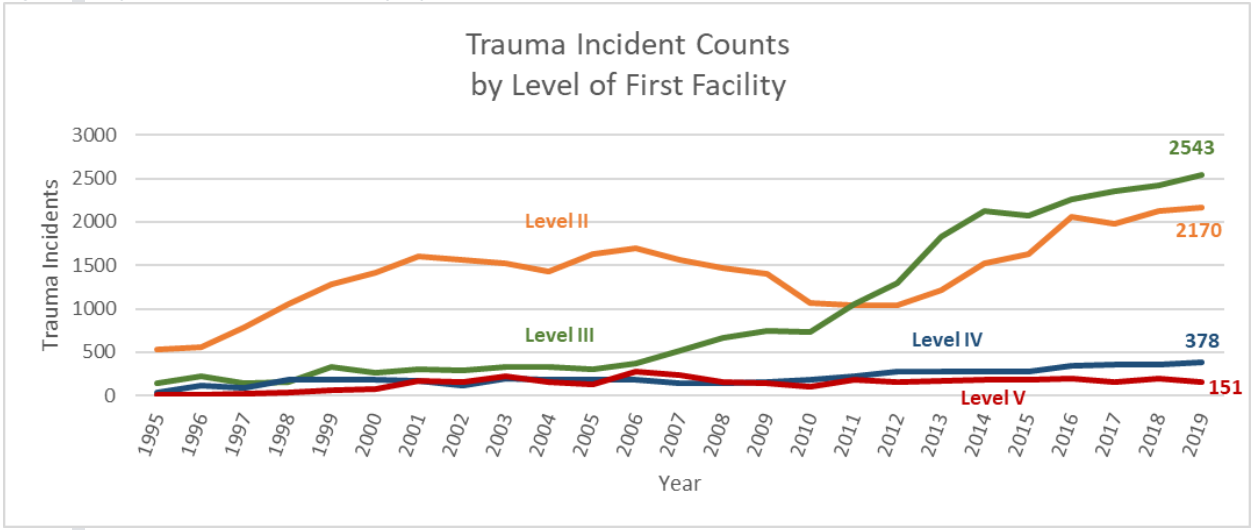

Figure 5 East Region Trauma Incident Counts by Level of First Facility, 1995-2019

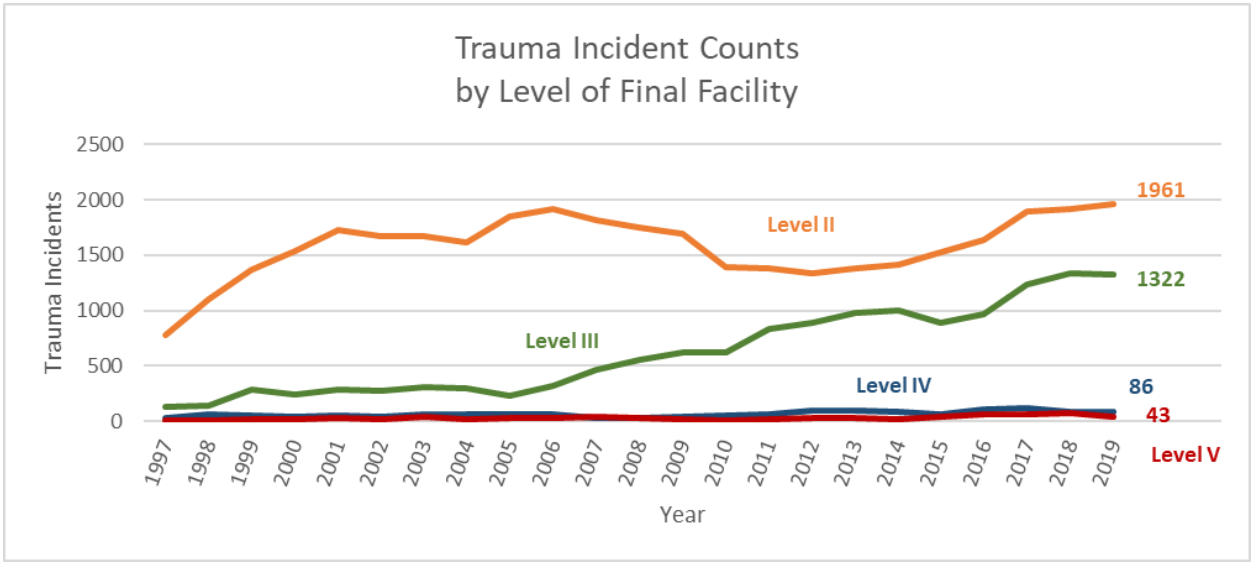

Figure 6 East Region Trauma Incident Counts by Level of Final Facility, 1995-2019

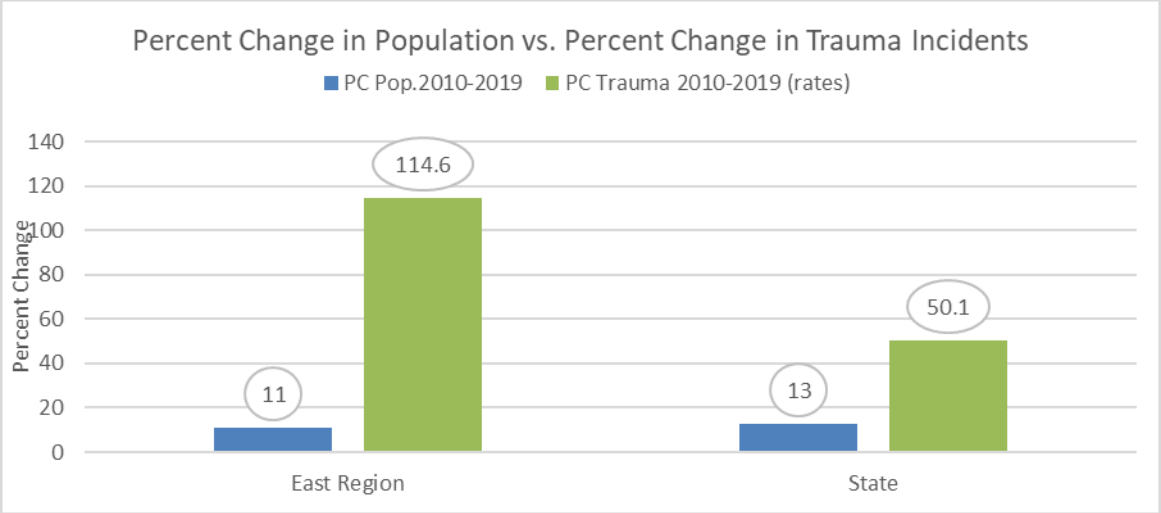

Figure 7 Regional % change in population and trauma incidents, Central Region vs. State

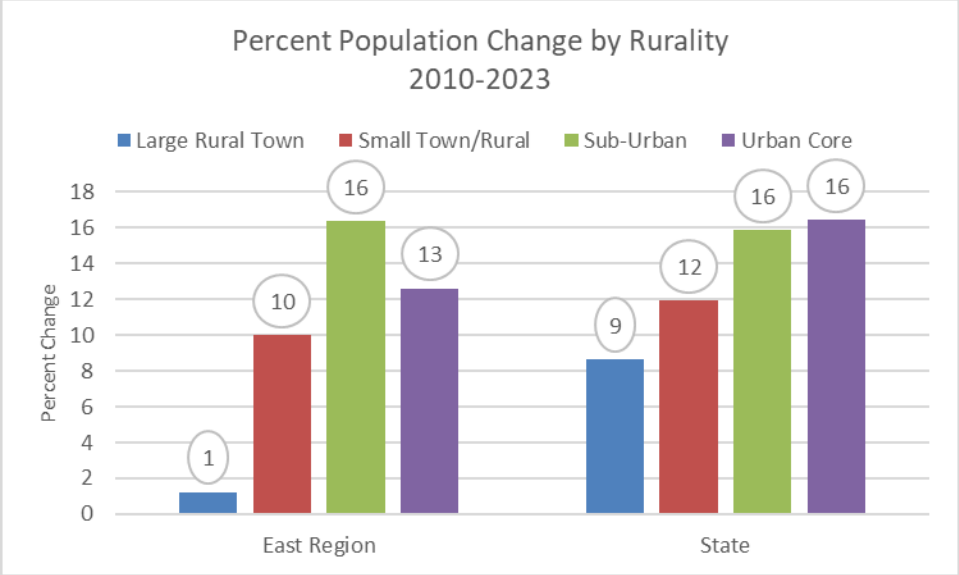

Figure 8 Rurality Population Percent Change, East Region vs. State, 2010-2023

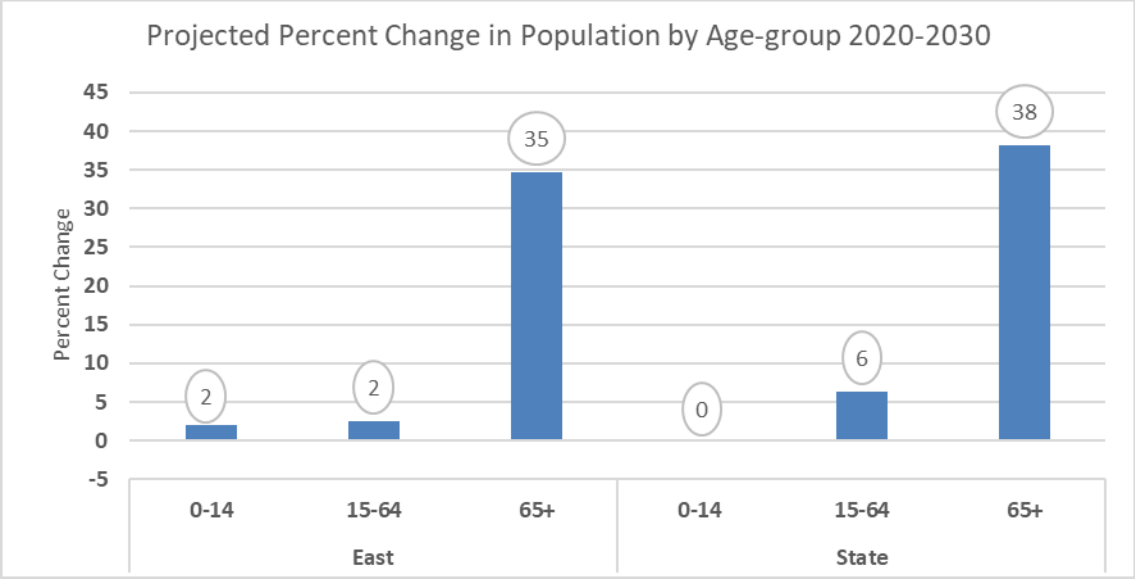

Figure 9 East Region vs. State projected population growth 2020-2030

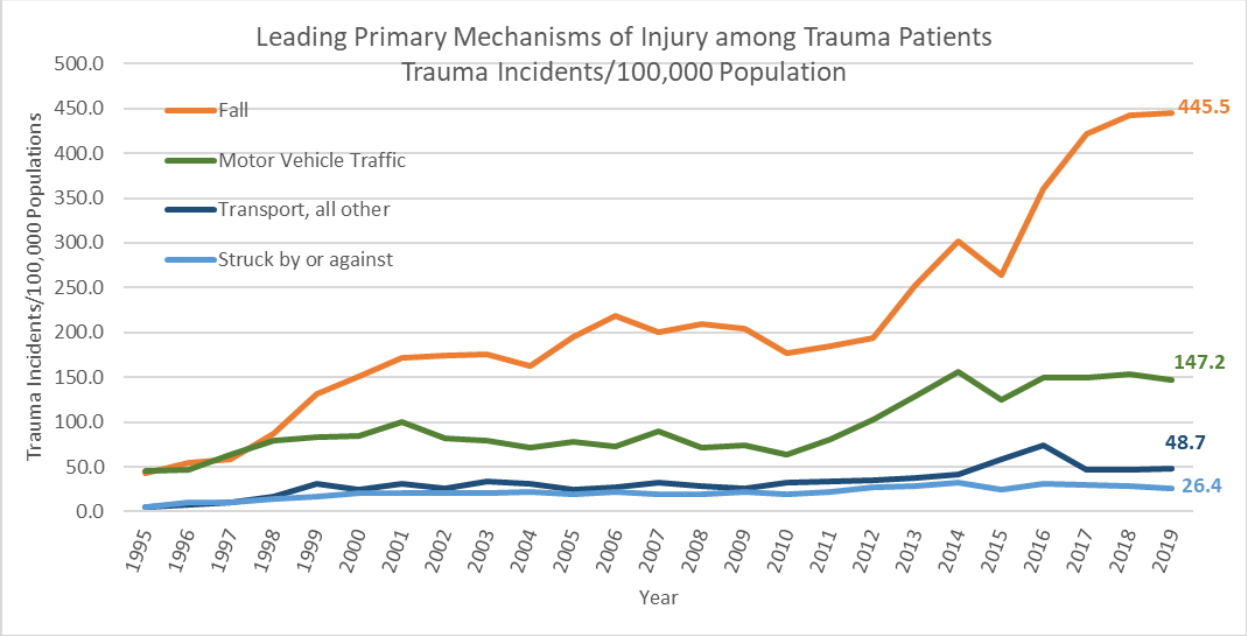

Figure 10 Leading Primary Mechanism of Injury, East Region,1995-2019

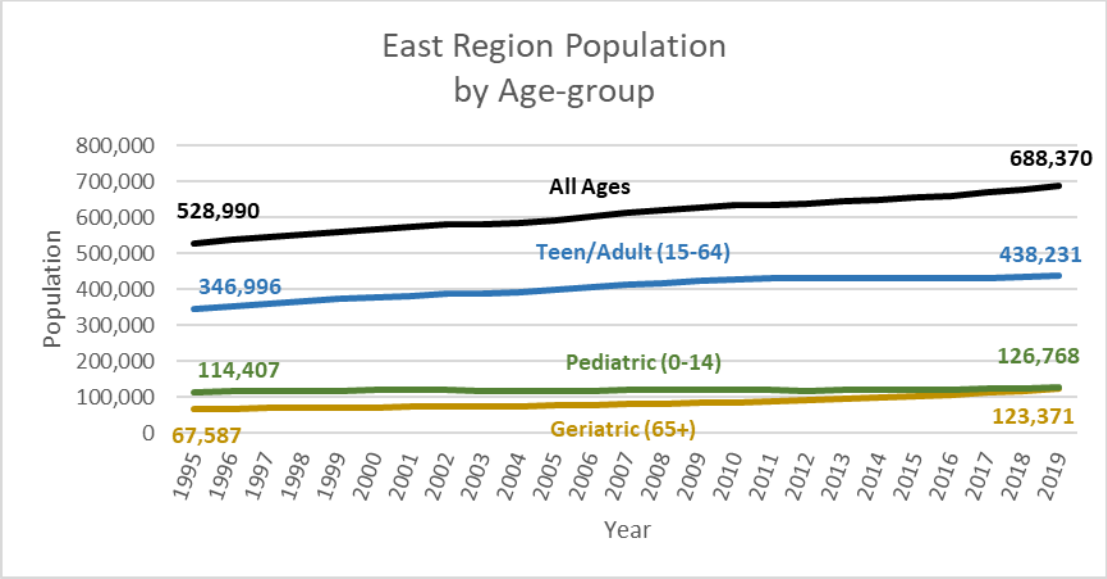

Figure 11 East Region Population by Age-group, 1995-2019

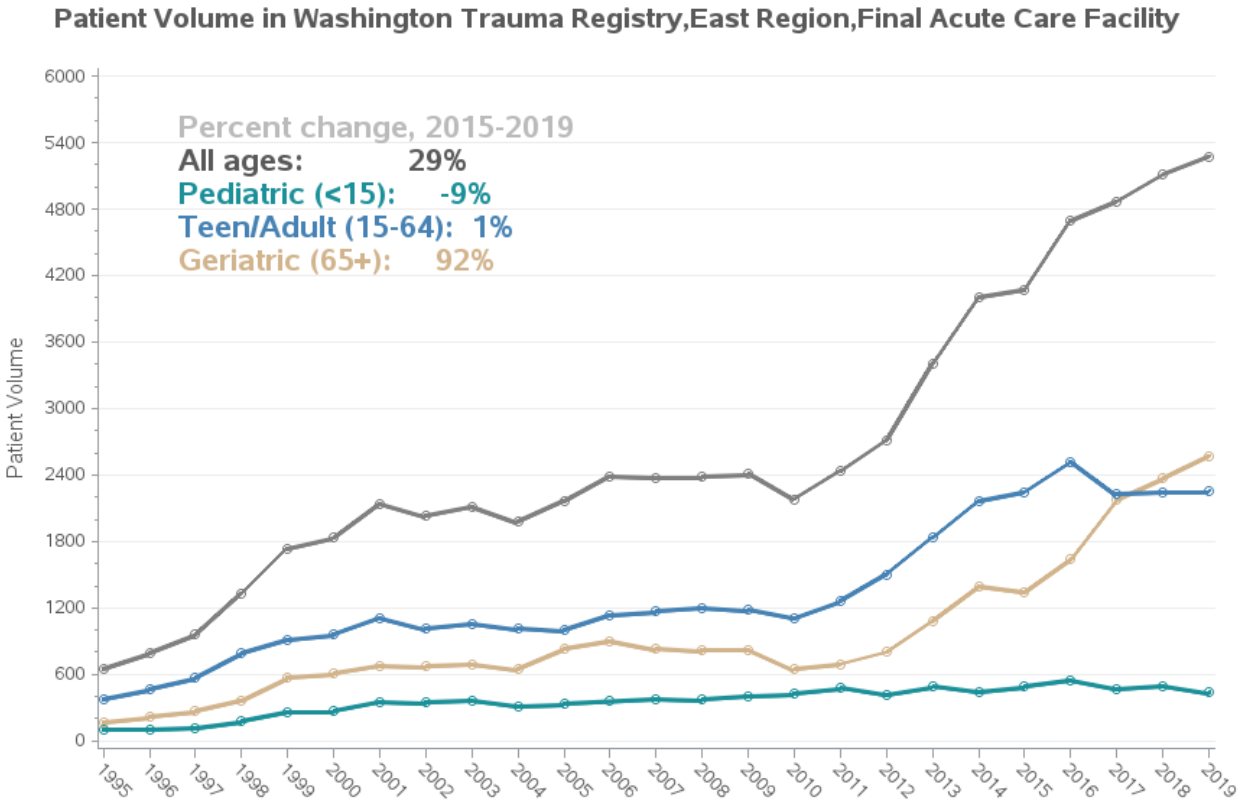

Figure 12 Trauma Volume by Age-group, East Region

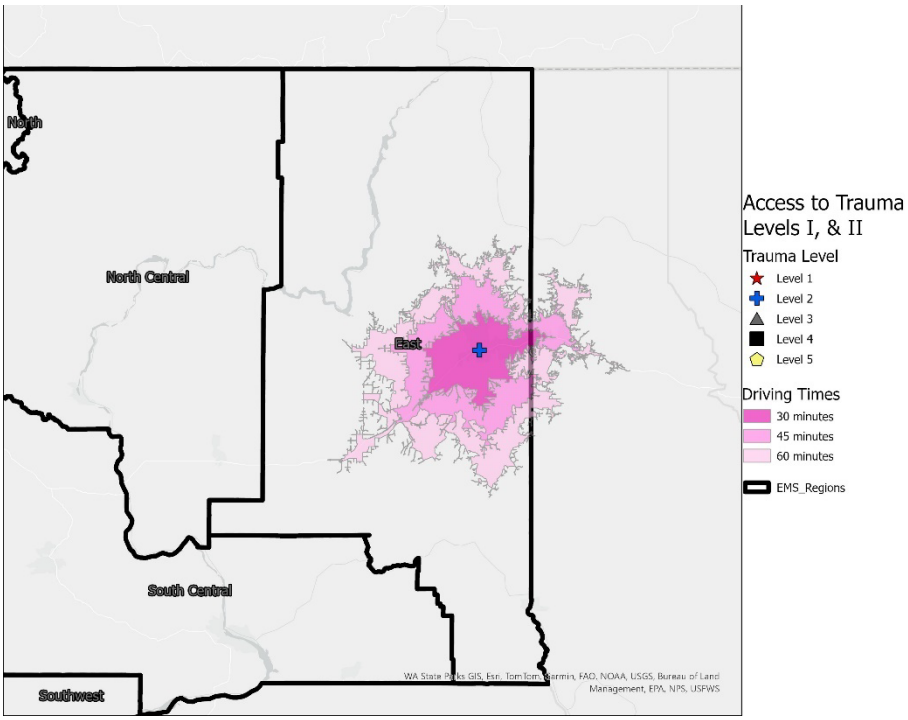

Figure 13 Trauma Levels I &II Driving Times to facilities within East Region

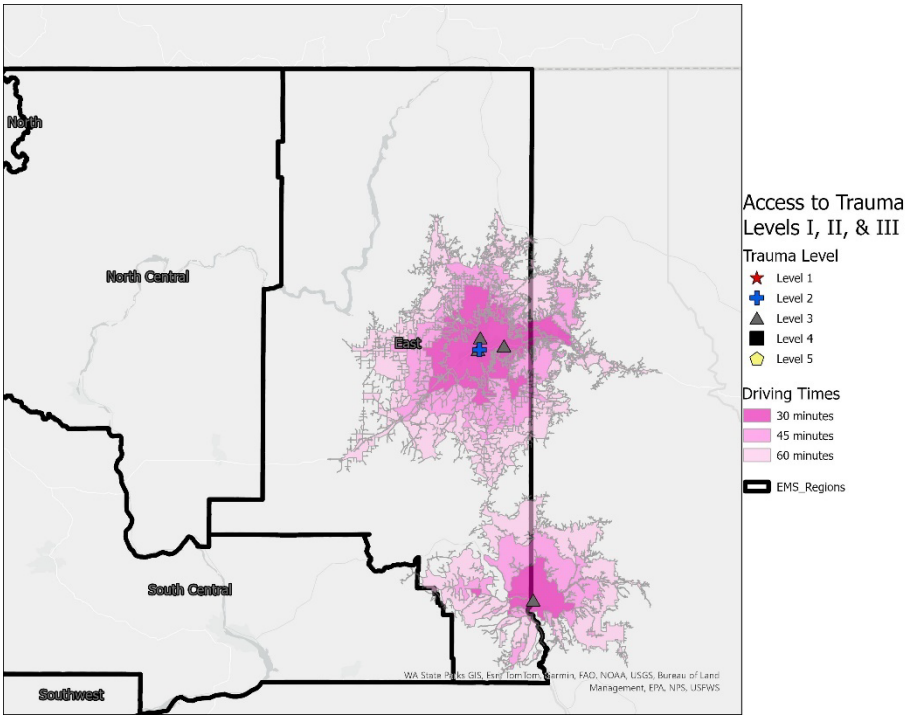

Figure 14 Trauma Levels I, II, & III Driving Times to facilities within East Region

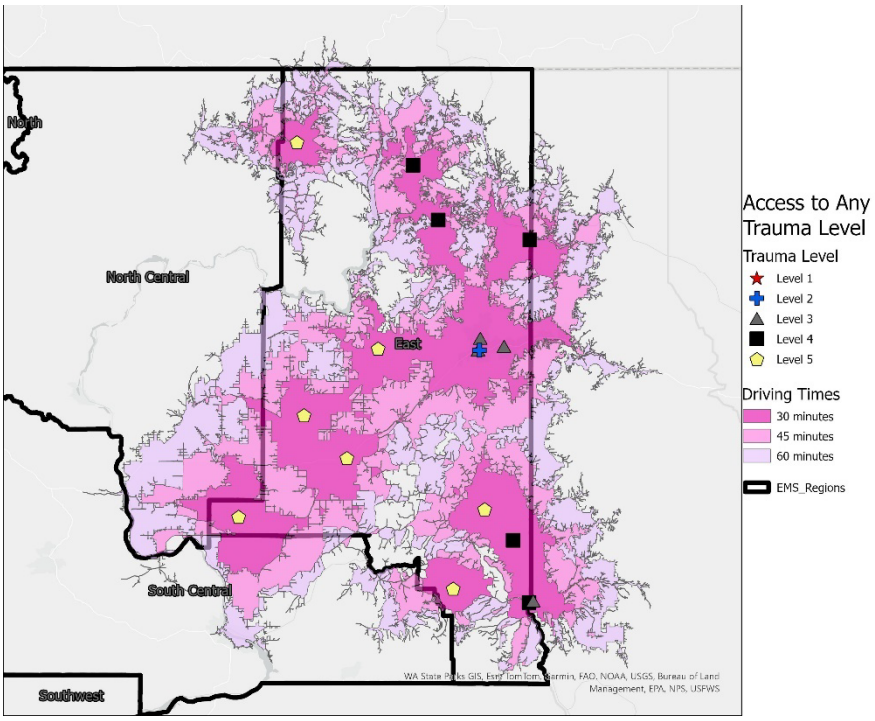

Figure 15 Any Trauma Level Driving Times to facilities within East Region

Population within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
East	≤30 min%	67%	75%	91%
	≤45 min%	74%	85%	97%
	≤60 min%	78%	92%	99%

Figure 16 East Region population within driving distances to trauma center

Percent of trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
East	≤30 min%	84%	88%	95%
	≤45 min%	89%	94%	99%
	≤60 min%	93%	97%	100%

Figure 17 East Region trauma incidents within driving distances to trauma centers

Percent of Severe Trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
East	≤30 min%	77%	81%	94%
	≤45 min%	85%	92%	100%
	≤60 min%	89%	96%	100%

Figure 18 East Region severe trauma incidents within driving distances to trauma centers

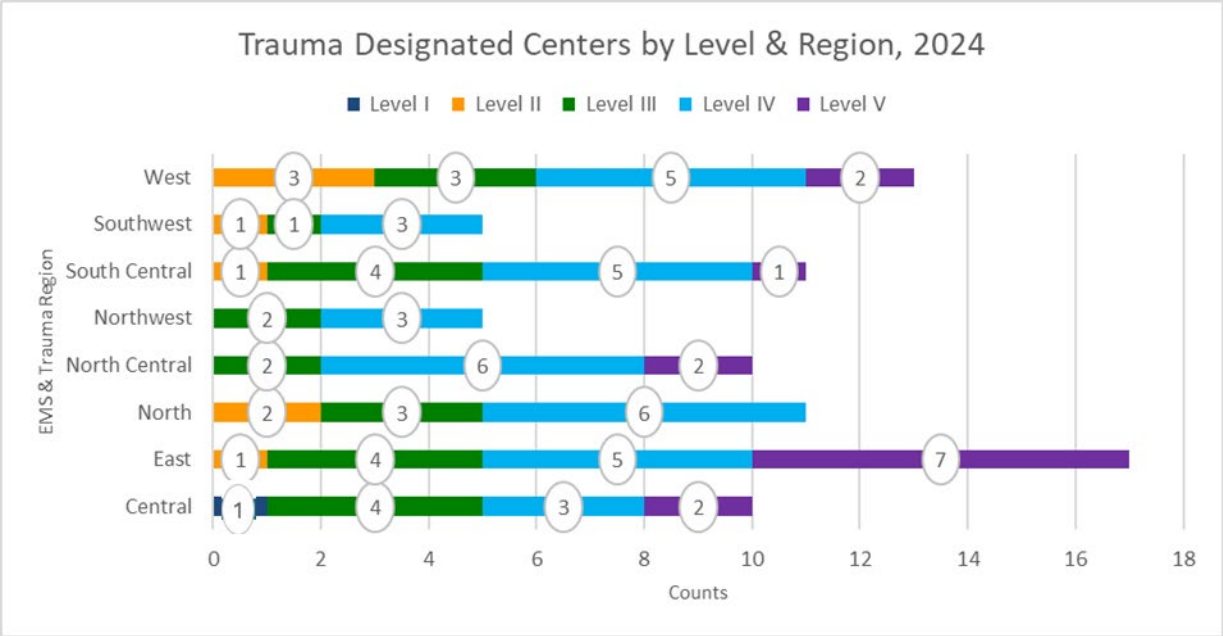

Figure 19 Trauma Designated Centers by Level & Region, 2024

Trauma Patients Initial and Highest Designated Level of Care (%), East Region, 2019

		Highest Level of Care				
		Level I	**Level II**	**Level III**	**Level IV**	**Level V**
Initial Level of Care	**Level I**	100%	-	-	-	-
	Level II	1%	99%	-	-	-
	Level III	-	7%	93%	-	-
	Level IV	3%	52%	3%	42%	-
	Level V	2%	48%	9%	-	41%

Figure 20 Trauma Patients Initial & Highest Designated Level of Care (%), East Region, 2019

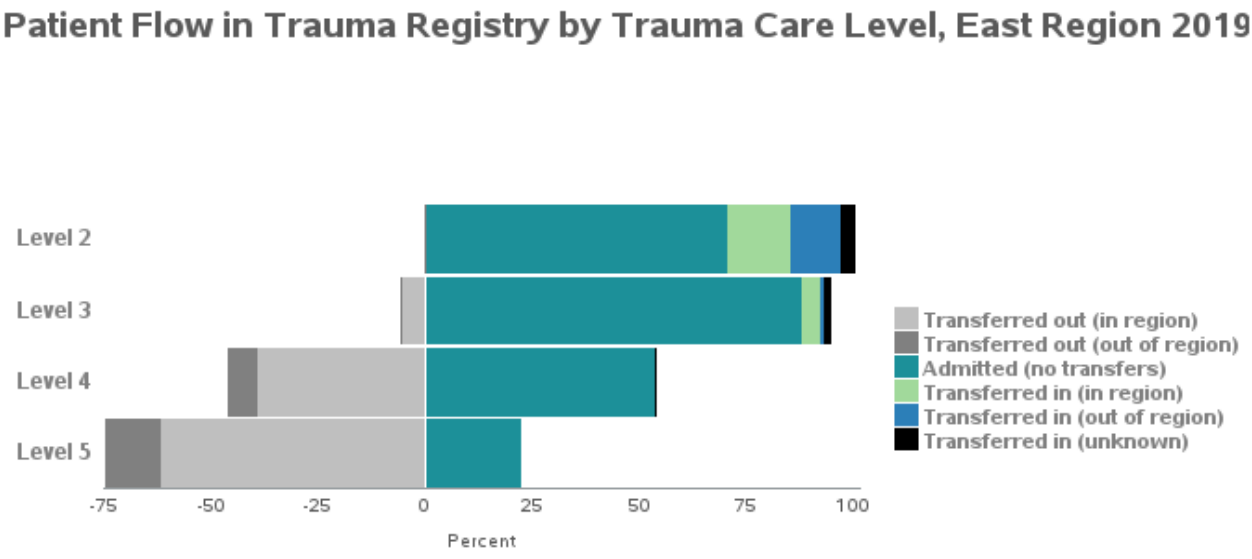

Figure 21 Patient Flow in Trauma Registry by Trauma Level of Care, East Region 2019

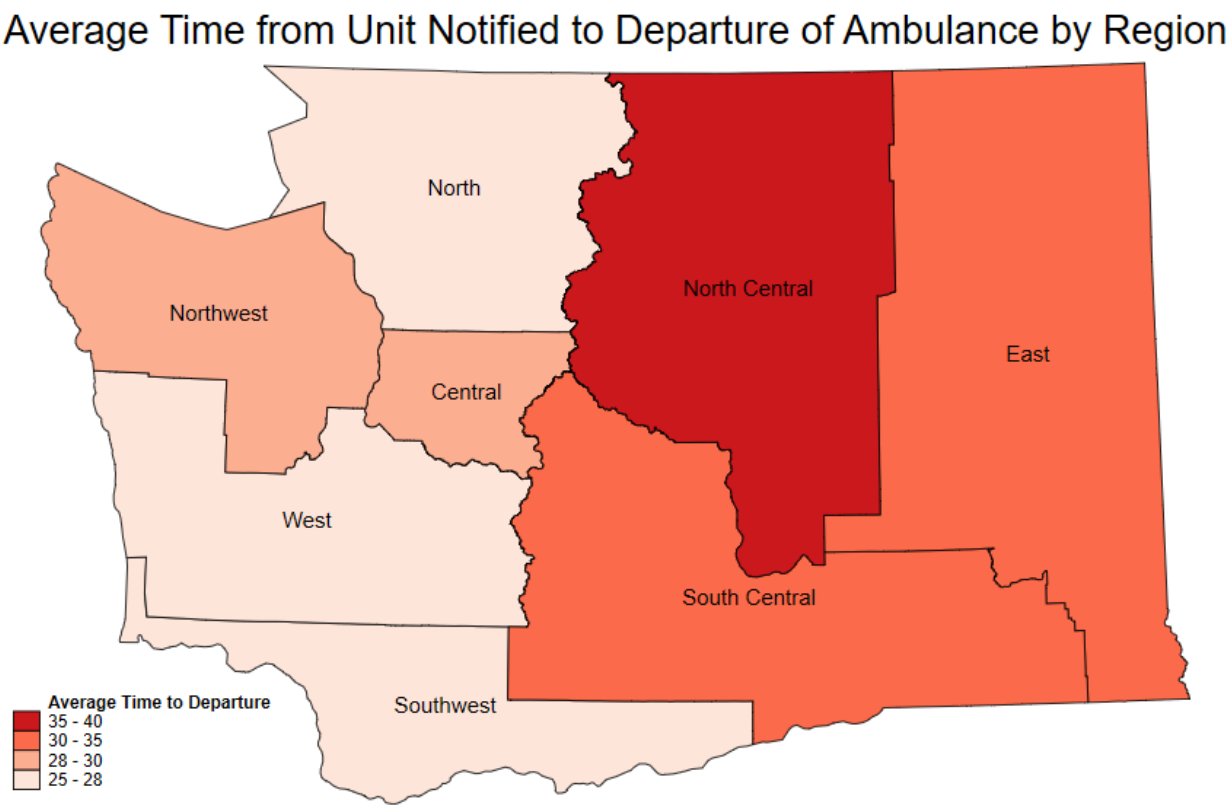

Figure 22 Average Time from EMS Unit Notification to Scene Departure by Region

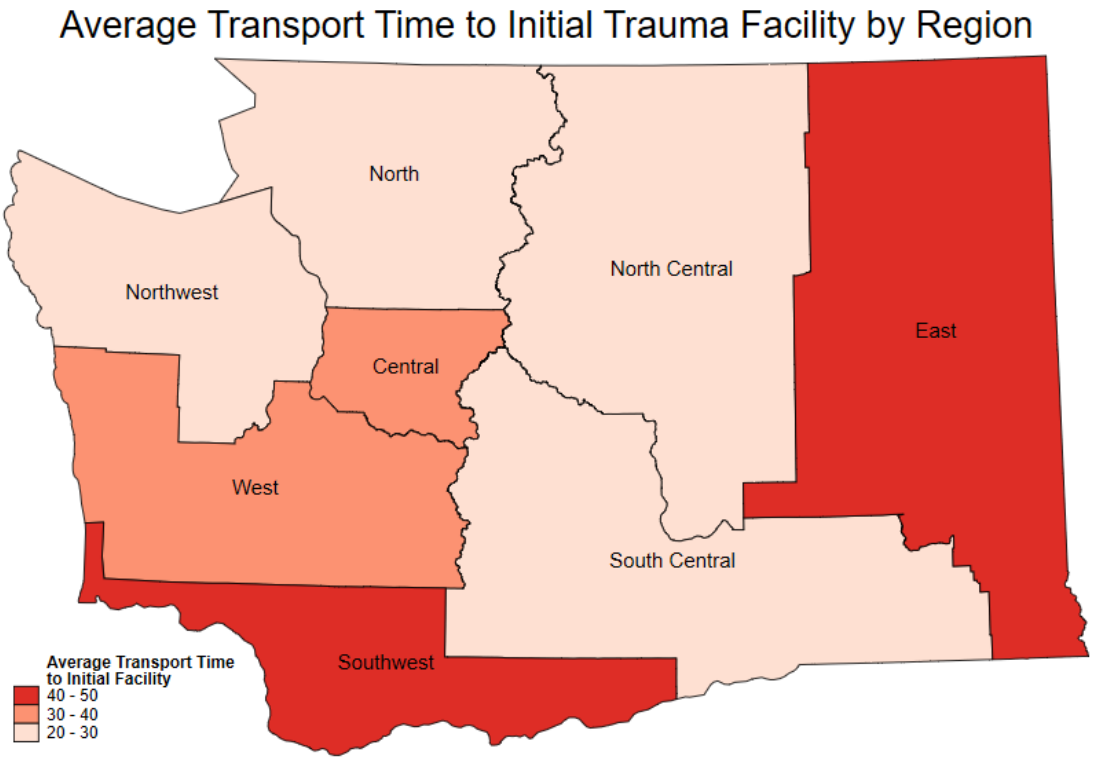

Figure 23 Average Transport Time from Scene Departure to Initial Facility by Region

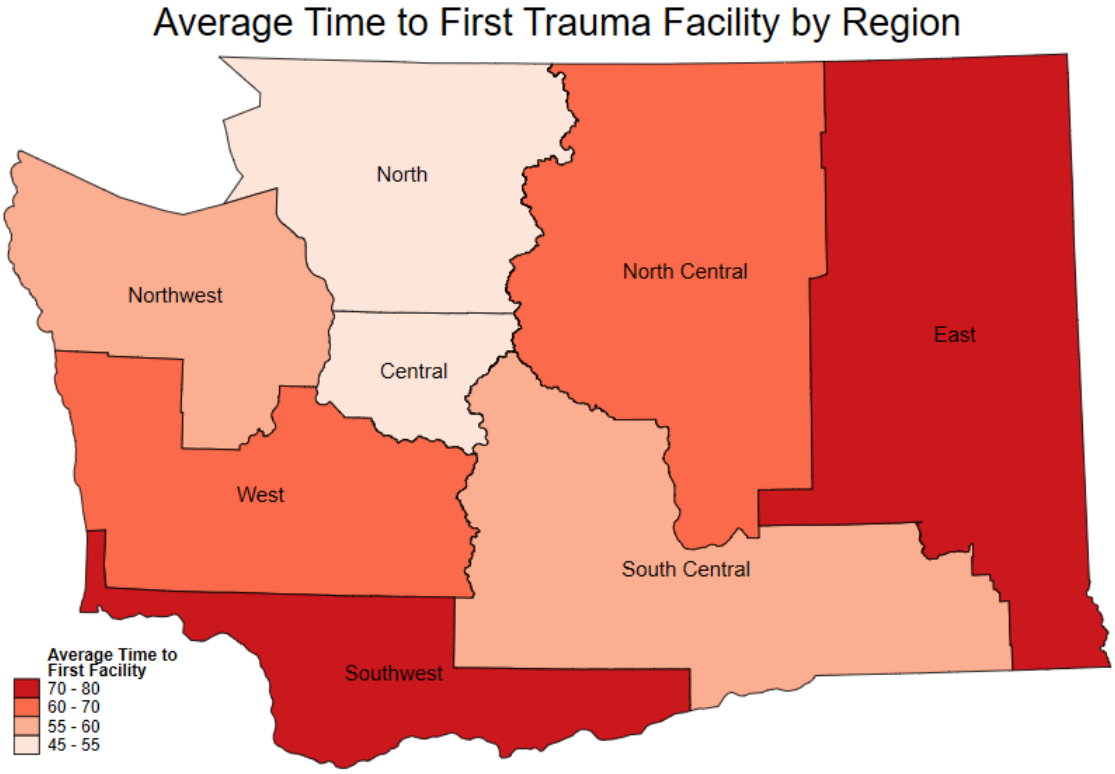

Figure 24 Average Time from EMS Unit Notification to First Trauma Facility by Region

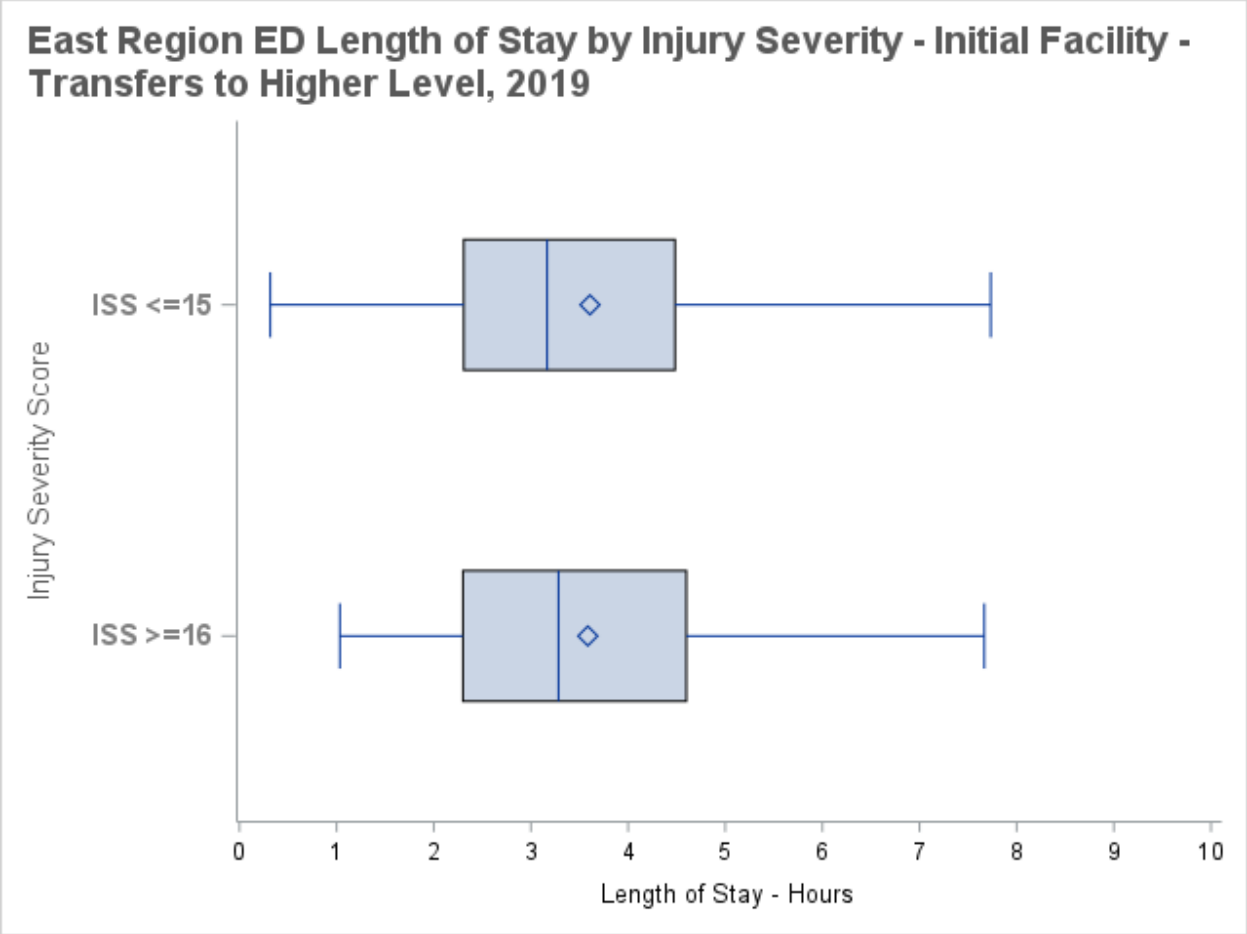

Figure 25 Regional Emergency Department Length of Stay at Initial Facility, Patients Transferred to Higher Level of Care, by ISS

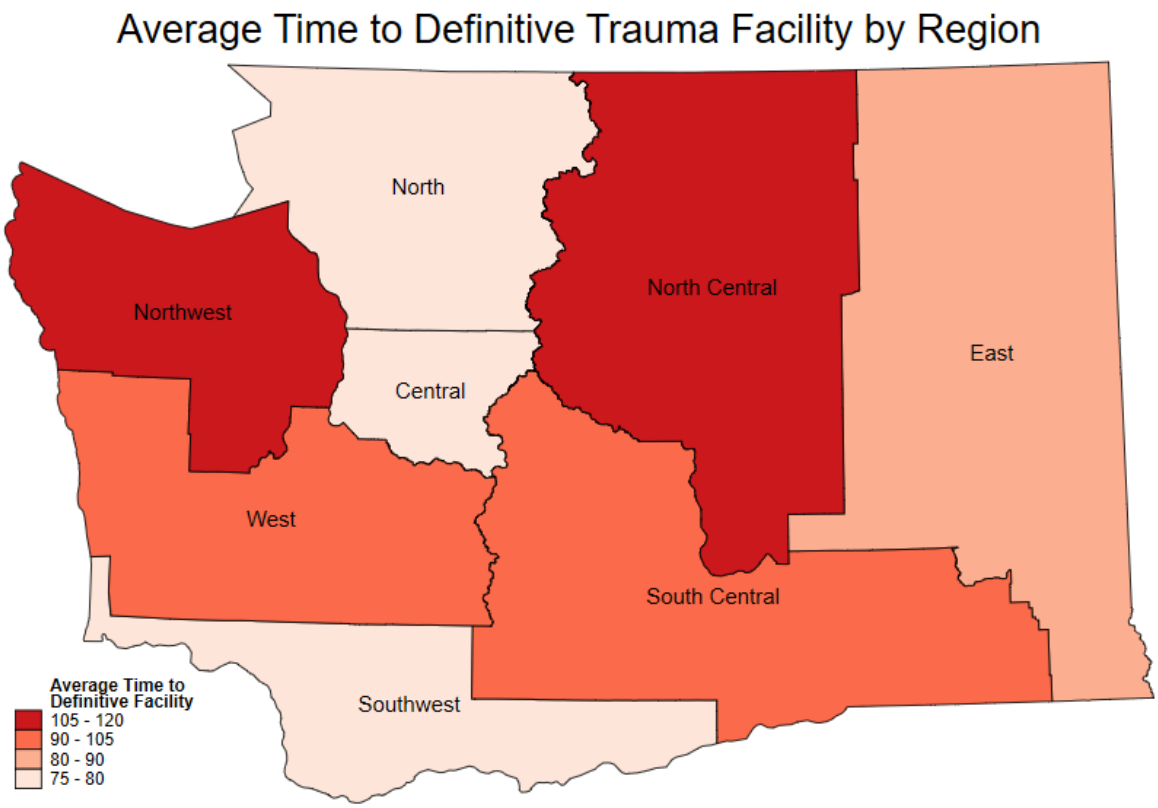

Figure 26 Average Time from EMS Unit Notification to Definitive Trauma Facility by Region

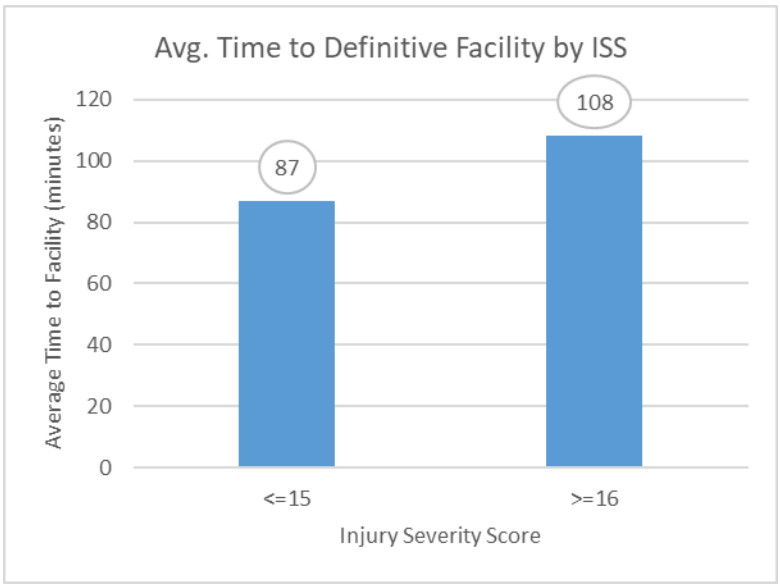

Figure 27 Average Time from EMS Unit Notification to Definitive Trauma Facility by Injury Severity Score, East Region

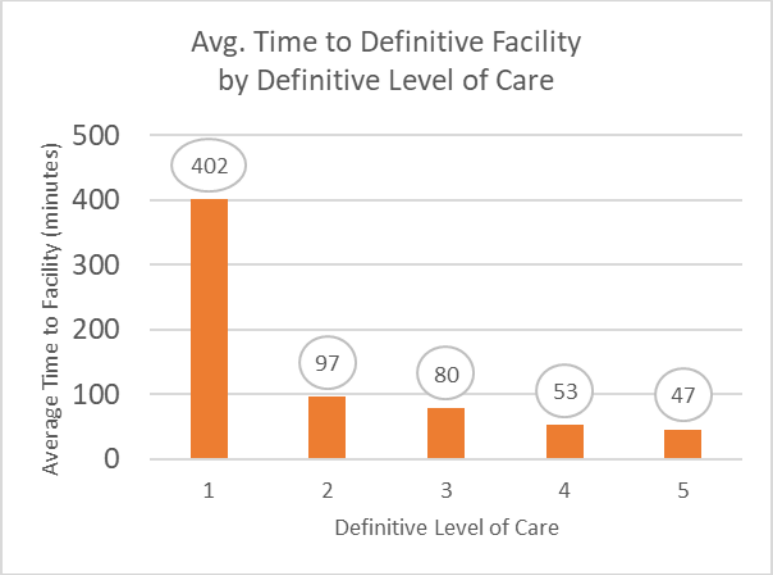

Figure 28 Average Time from EMS Unit Notification to Definitive Care by Level of Definitive Facility, East Region, 2019

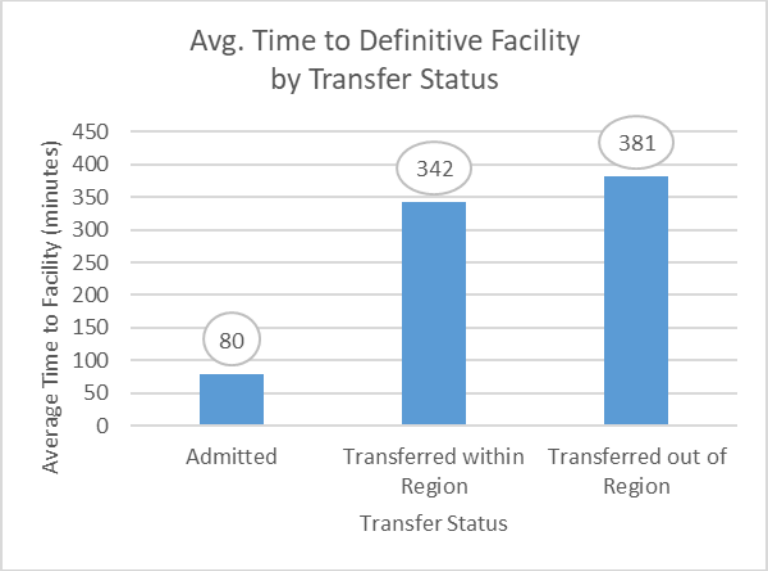

Figure 29 Average Time from EMS Unit Notification to Definitive Facility by Transfer Status, East Region, 2019

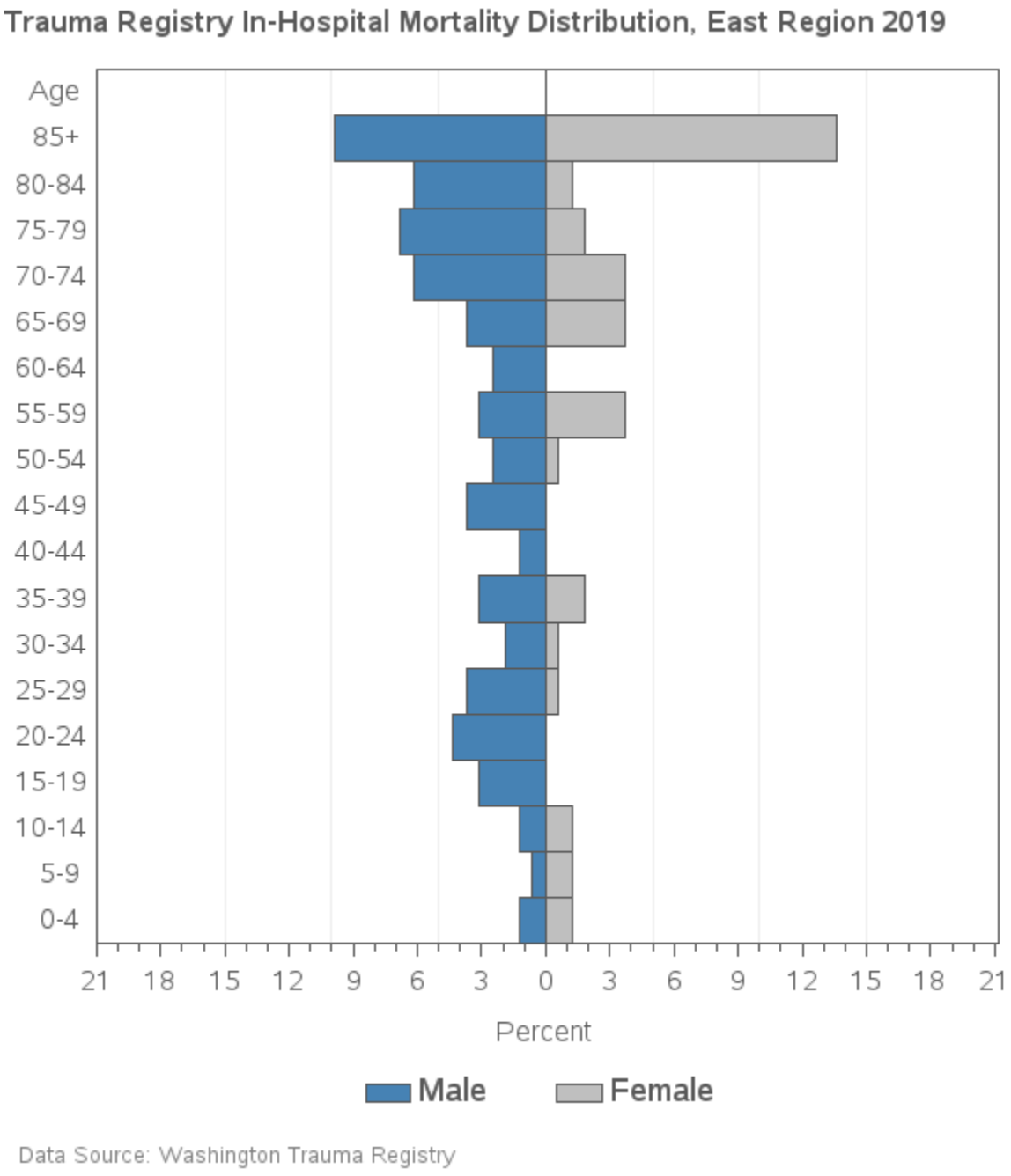

Figure 30 Trauma Registry In-hospital Mortality Distribution, East Region 2019

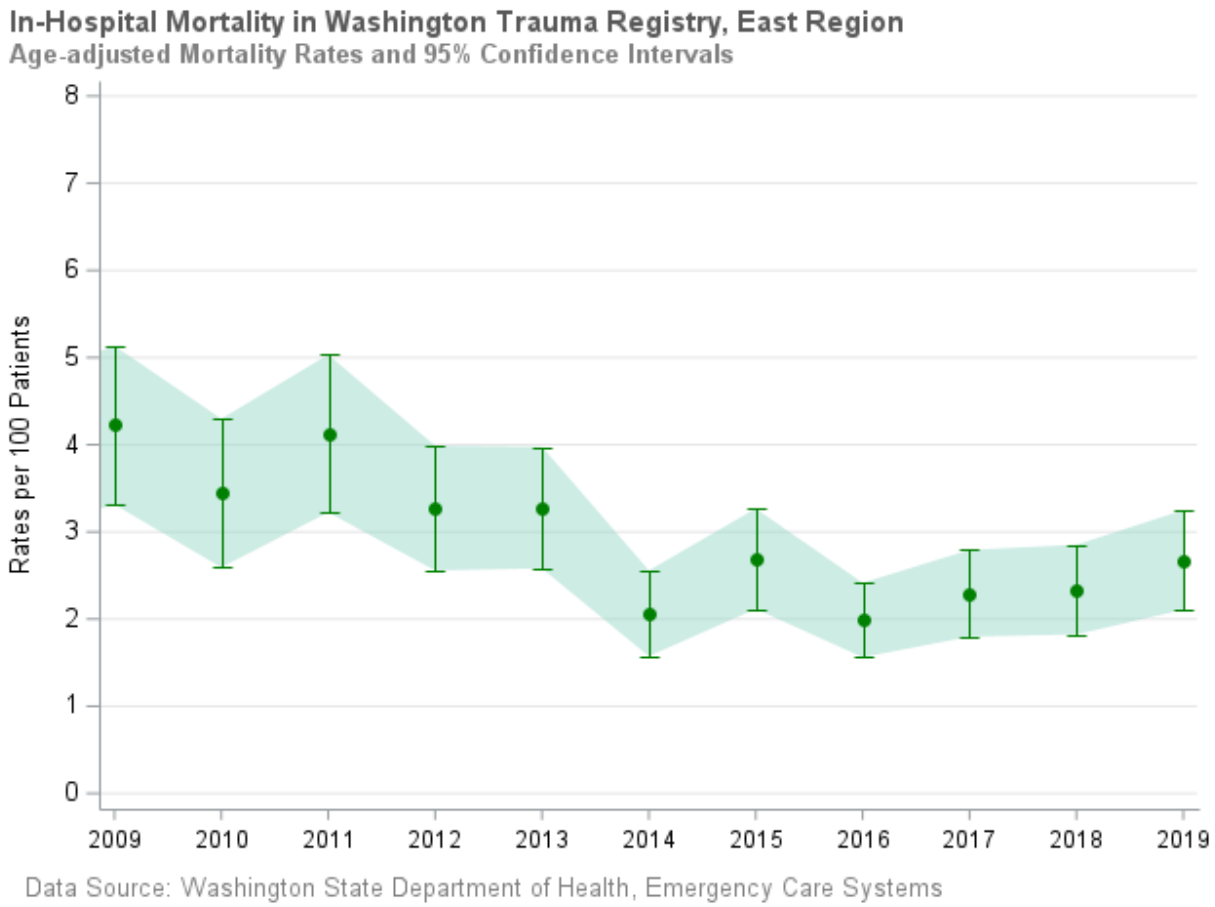

Figure 31 Age-adjusted Mortality Rates in WA Trauma Registry, East Region, 2019

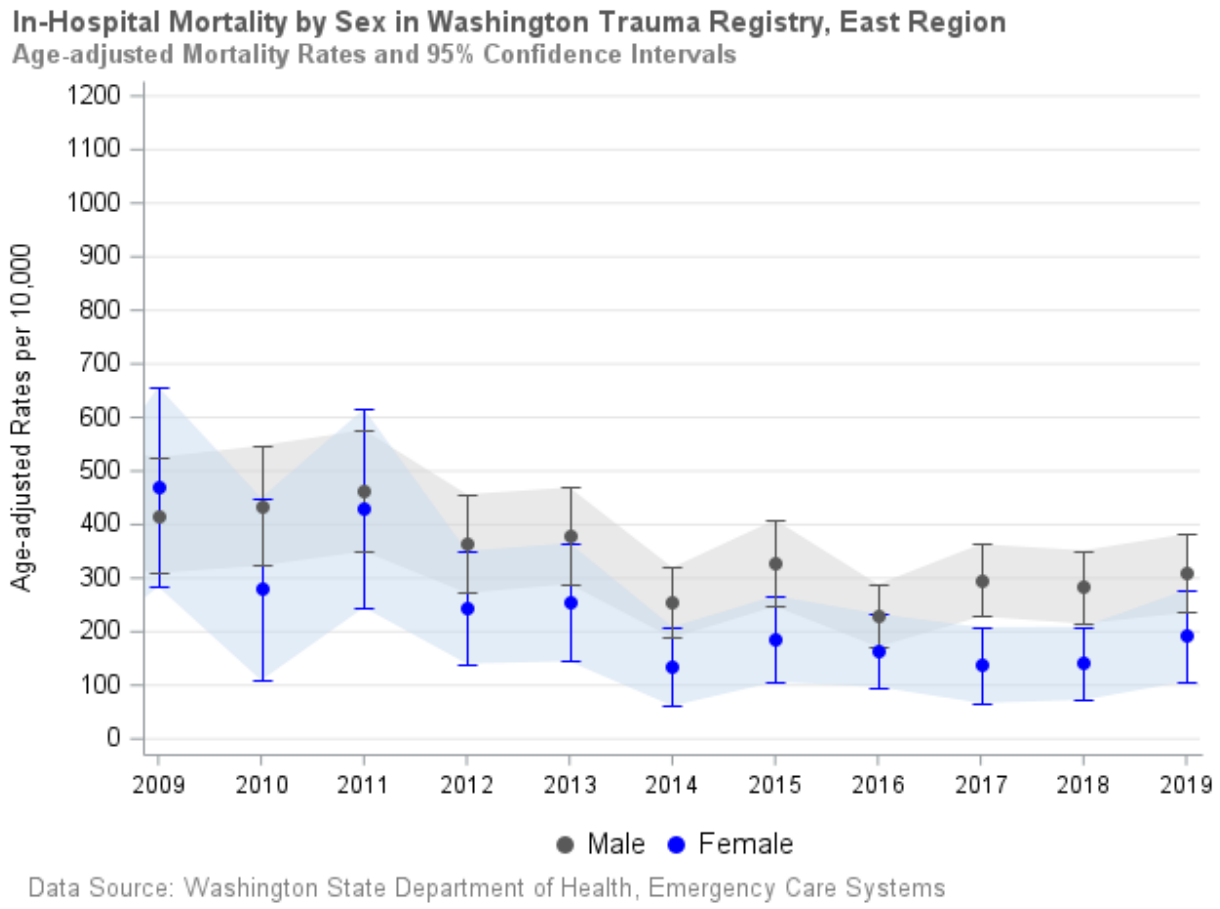

Figure 32 Age-adjusted Mortality Rates by Sex in WA Trauma Registry, East Region, 2019

North Region data figures and tables

Projected Percent Change in Population by EMS and Trauma Region

Region	Projected Change 2020-2030
North	+19%
State	+10%

Figure 1 Population % Change, 2020-2030, EMS & Trauma Region

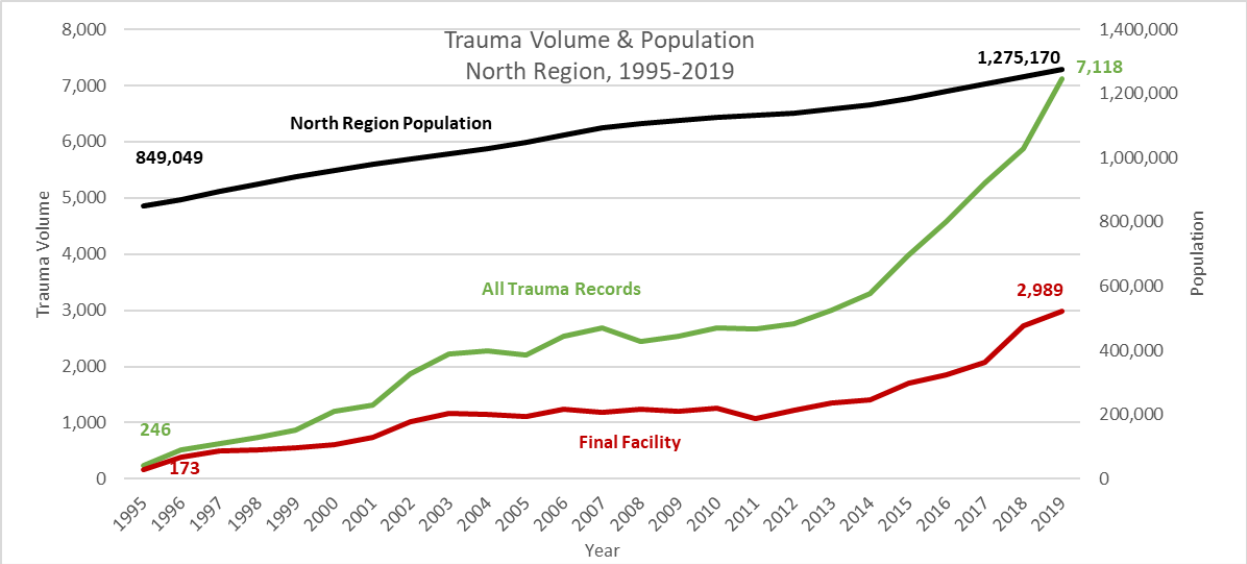

Figure 2 Trauma Volume & Population, North Region 1995-2019

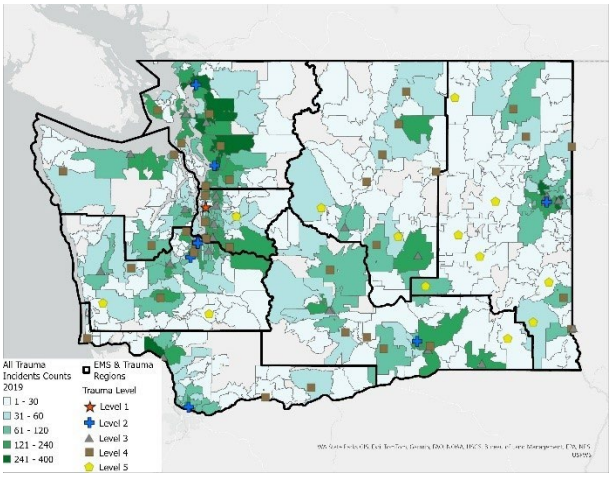

Figure 3 Map of Severe Trauma Distribution by Zip Code, 2019

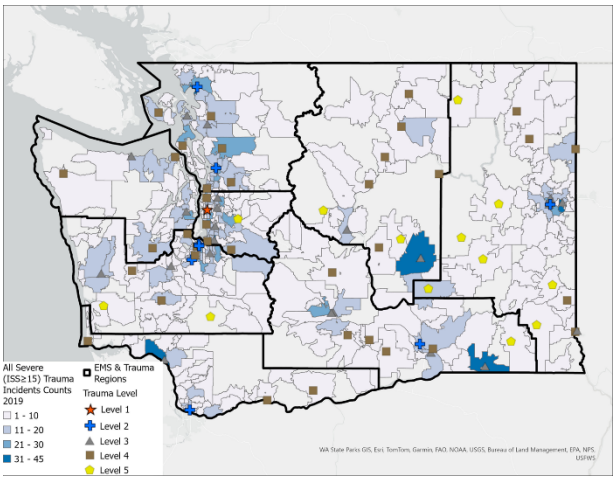

Figure 4 Map of Trauma Distribution by Zip Code, 2019

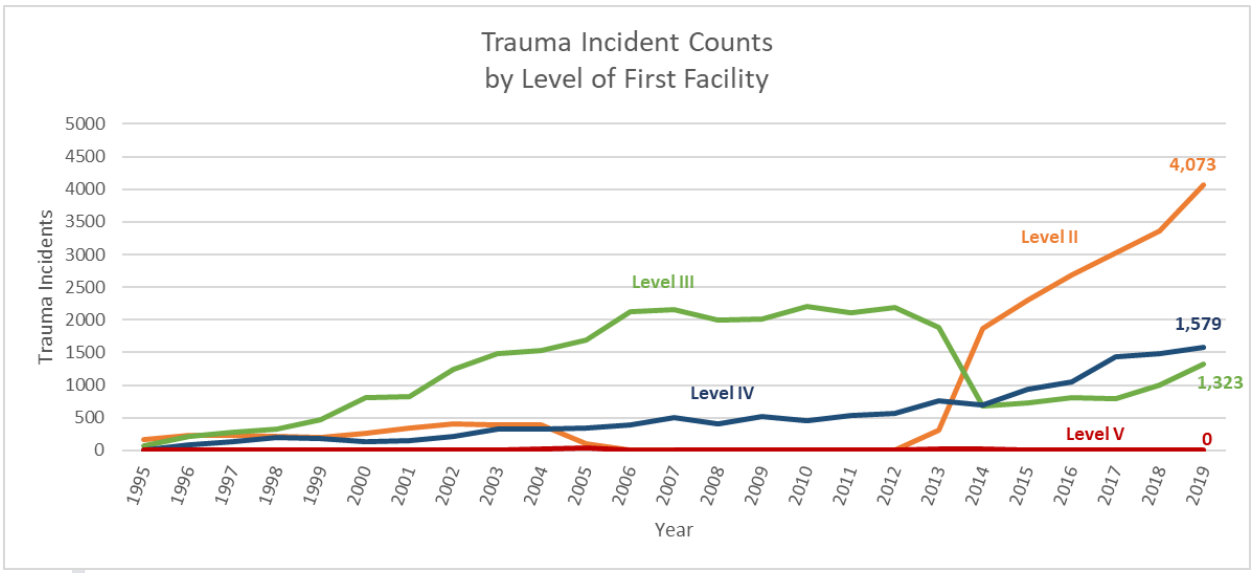

Figure 5 North Region Trauma Incident Counts by Level of First Facility, 1995-2019

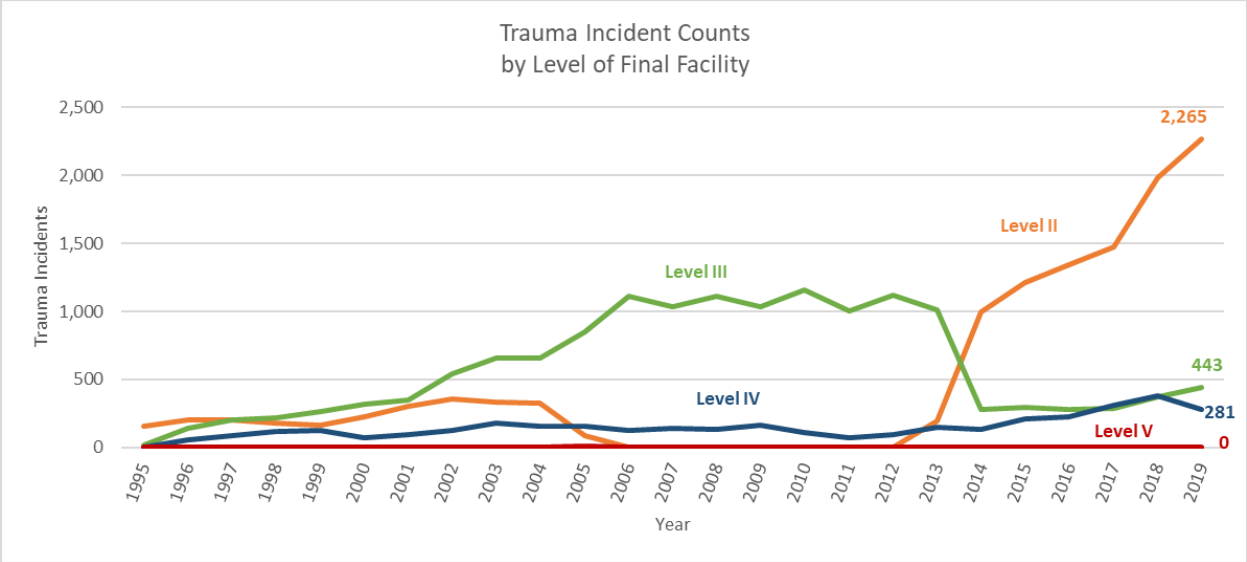

Figure 6 North Region Trauma Incident Counts by Level of Final Facility, 1995-2019

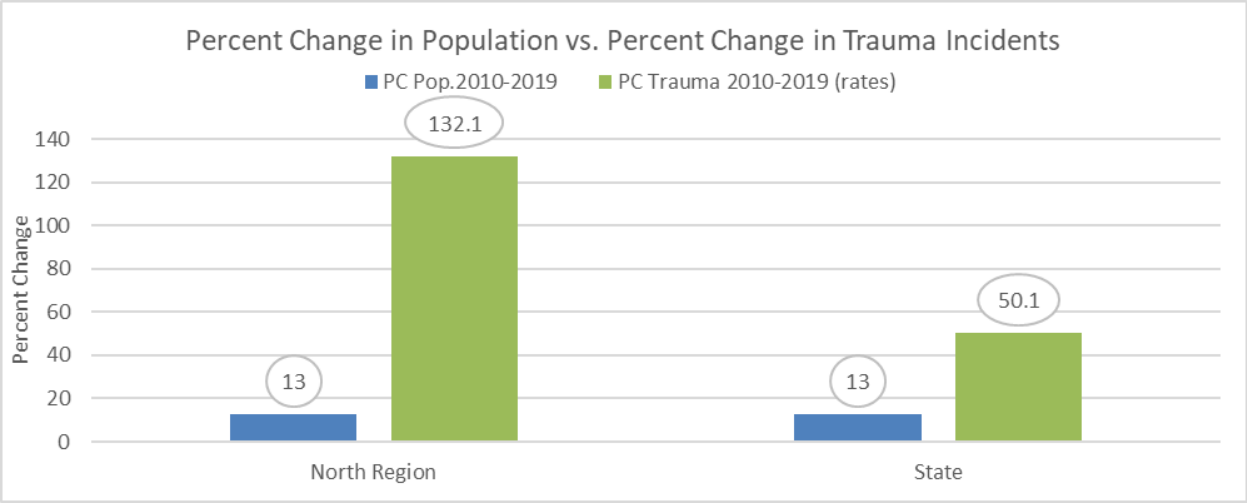

Figure 7 % change in population and trauma incidents, North Region vs. State

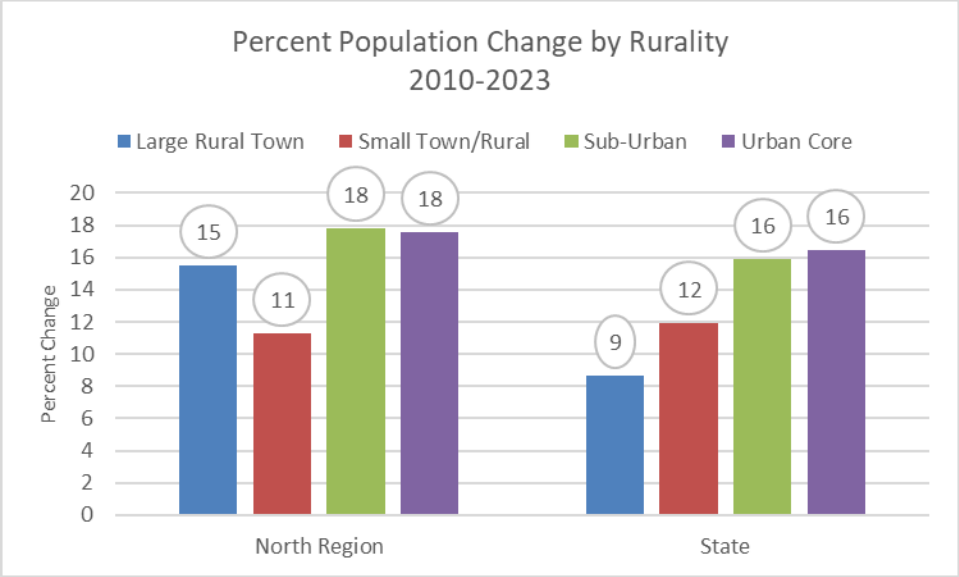

Figure 8 Rurality Population Percent Change, North Region vs. State, 2010-2023

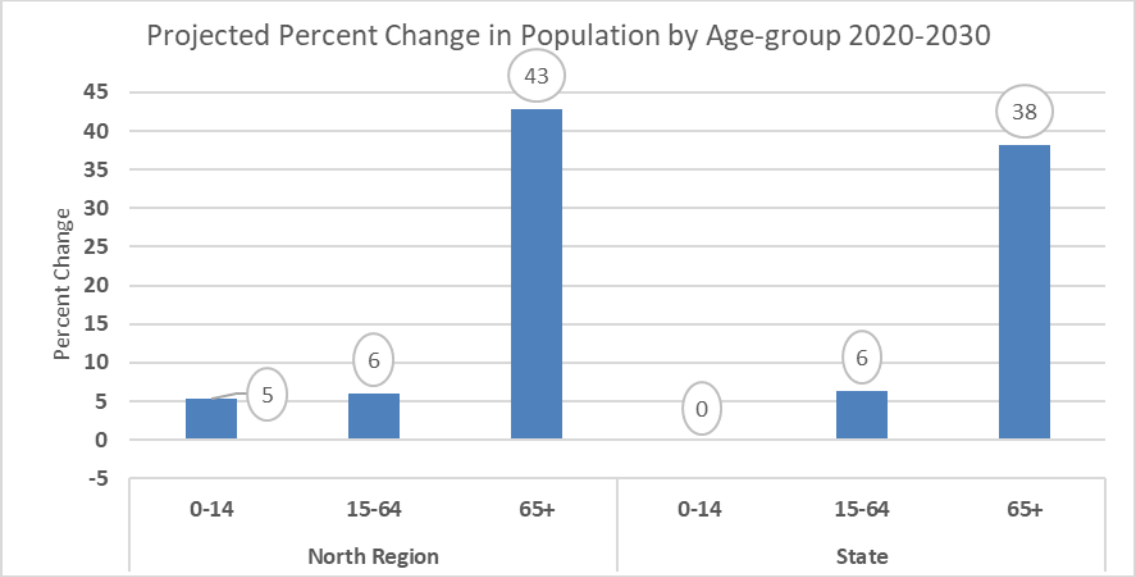

Figure 9 North Region vs. State projected population growth 2020-2030

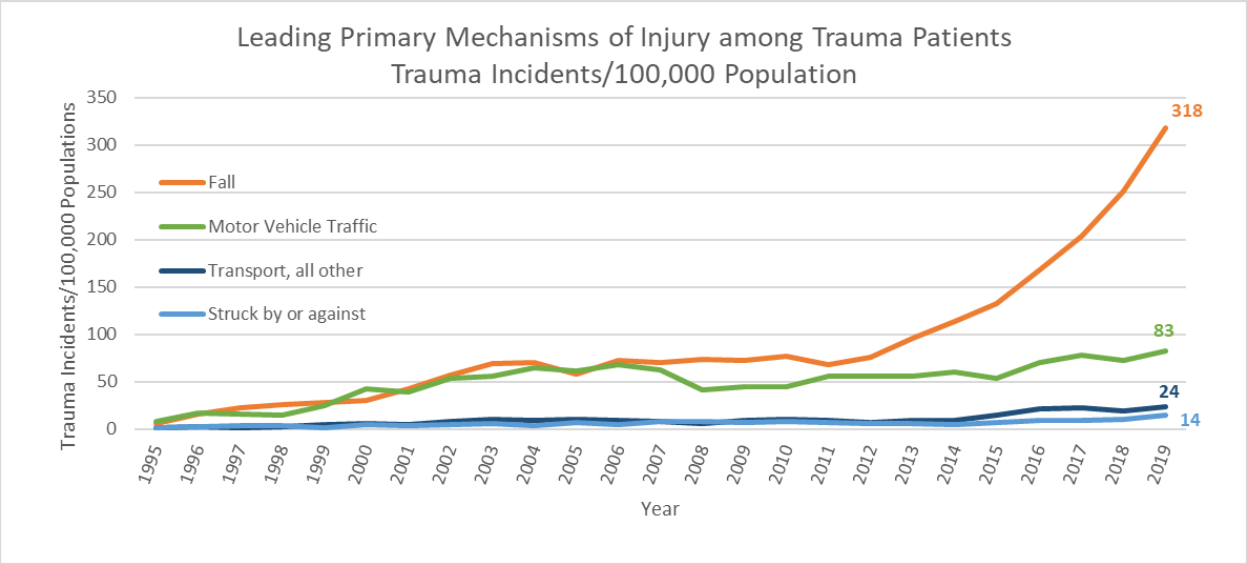

Figure 10 Leading Primary Mechanism of Injury, North Region,1995-2019

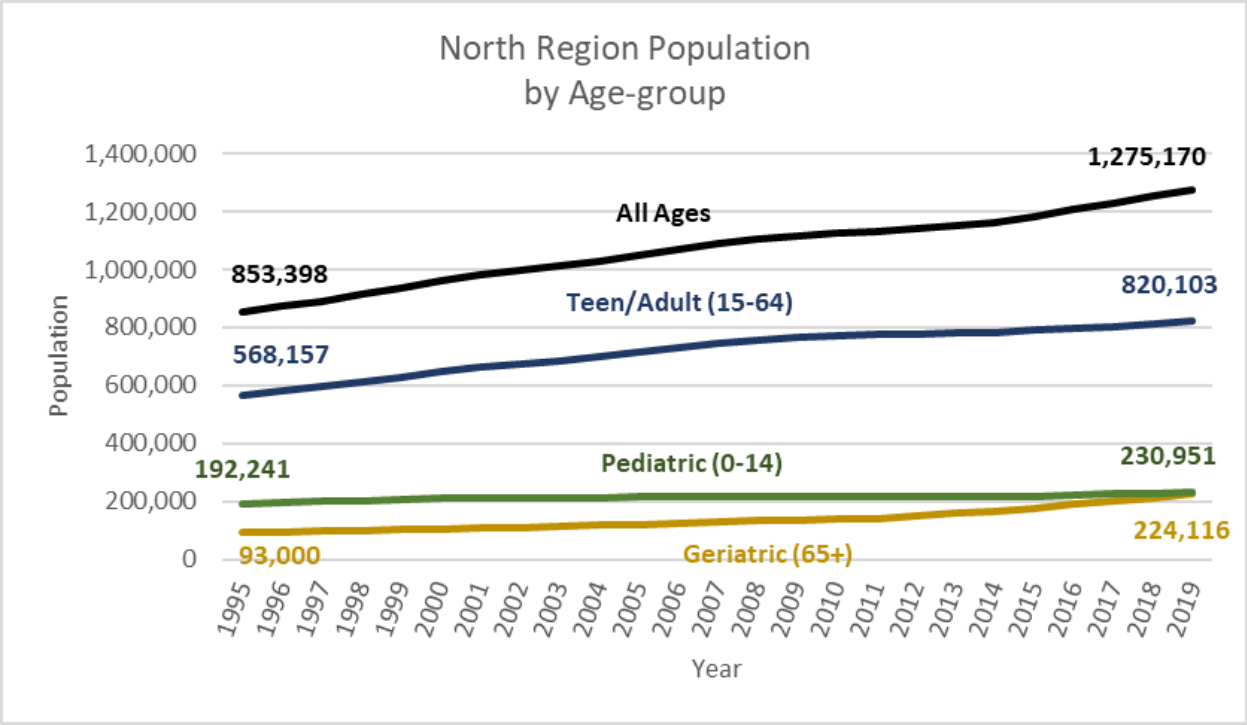

Figure 11 North Region Population by Age-group, 1995-2019

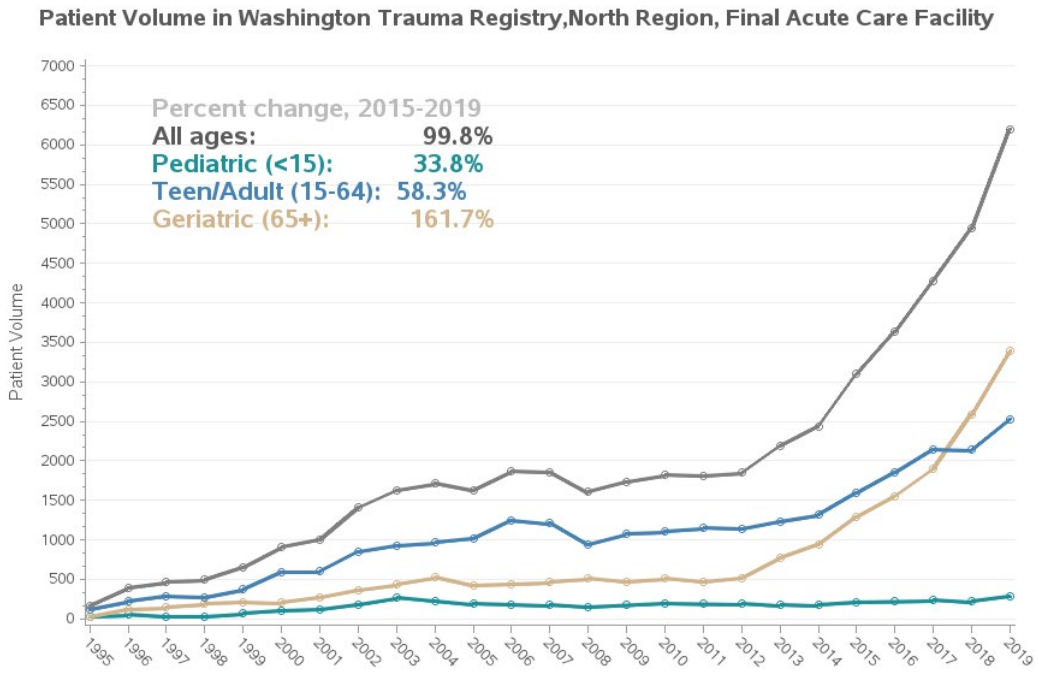

Figure 12 Trauma Volume by Age-group, North Region

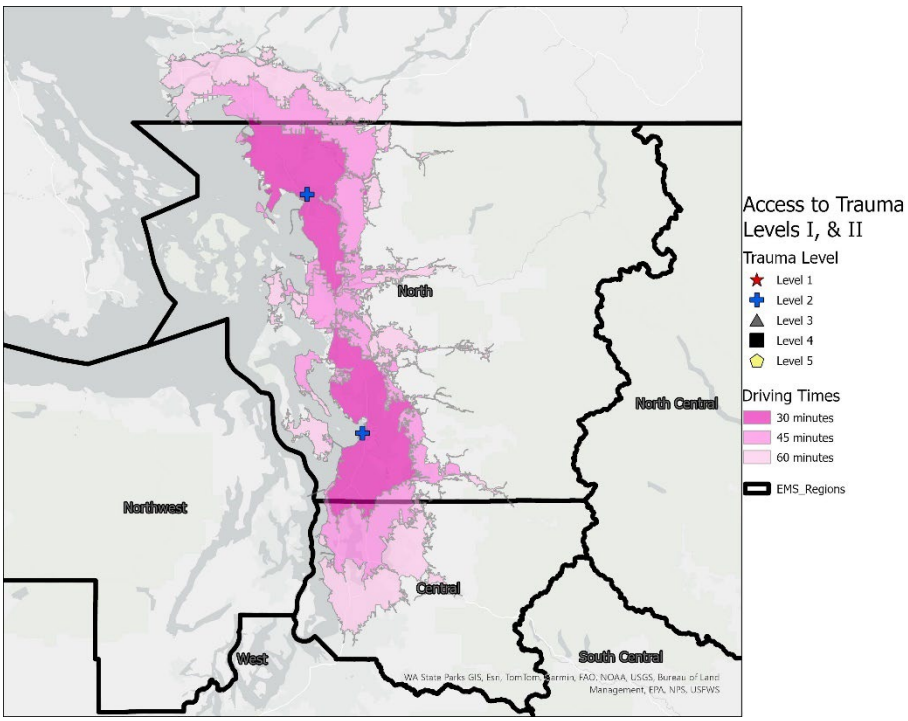

Figure 13 Trauma Levels I &II Driving Times to facilities within North Region

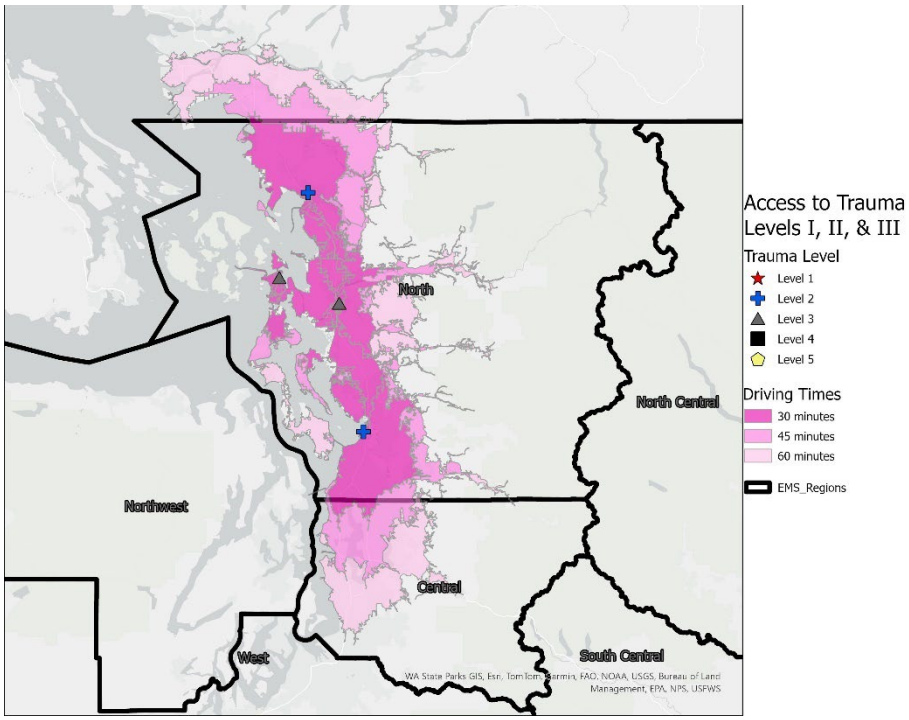

Figure 14 Trauma Levels I, II, & III Driving Times to facilities within North Region

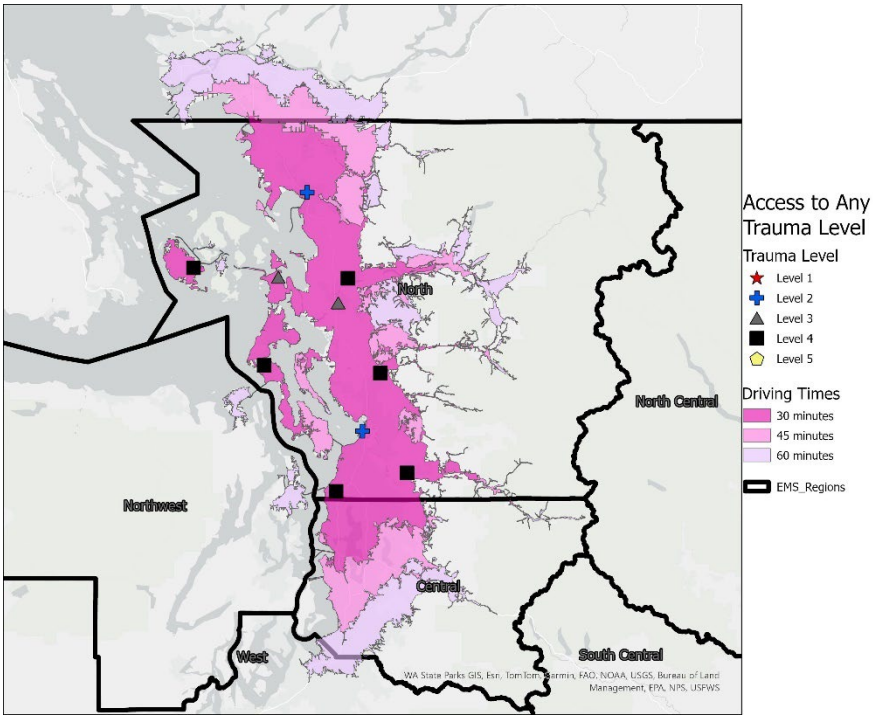

Figure 15 Any Trauma Level Driving Times to facilities within North Region

Population within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
North	≤30 min%	76%	86%	93%
	≤45 min%	88%	94%	97%
	≤60 min%	92%	96%	98%

Figure 16 North Region population within driving distances to trauma center

Percent of trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
North	≤30 min%	70%	87%	93%
	≤45 min%	86%	93%	97%
	≤60 min%	92%	95%	98%

Figure 17 North Region trauma incidents within driving distances to trauma centers

Percent of Severe Trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
North	≤30 min%	68%	85%	95%
	≤45 min%	83%	90%	98%
	≤60 min%	90%	95%	99%

Figure 18 Central Region severe trauma incidents within driving distances to trauma centers

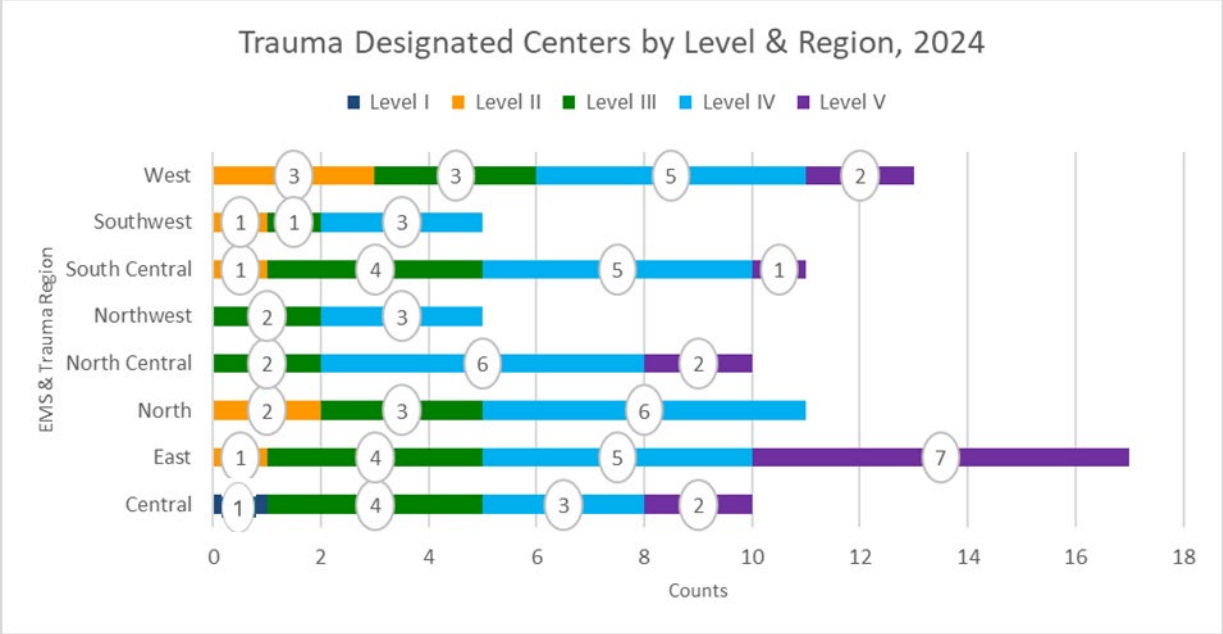

Figure 19 Trauma Designated Centers by Level & Region, 2024

Trauma Patients Initial and Highest Designated Level of Care (%), North Region, 2019

		Highest Level of Care				
		Level I	Level II	Level III	Level IV	Level V
Initial Level of Care	Level I	100%	-	-	-	-
	Level II	9%	91%	-	-	-
	Level III	16%	2%	82%	-	-
	Level IV	12%	11%	-	77%	-
	Level V	-	-	-	-	-

Figure 20 Trauma Patients Initial & Highest Designated Level of Care (%), North Region, 2019

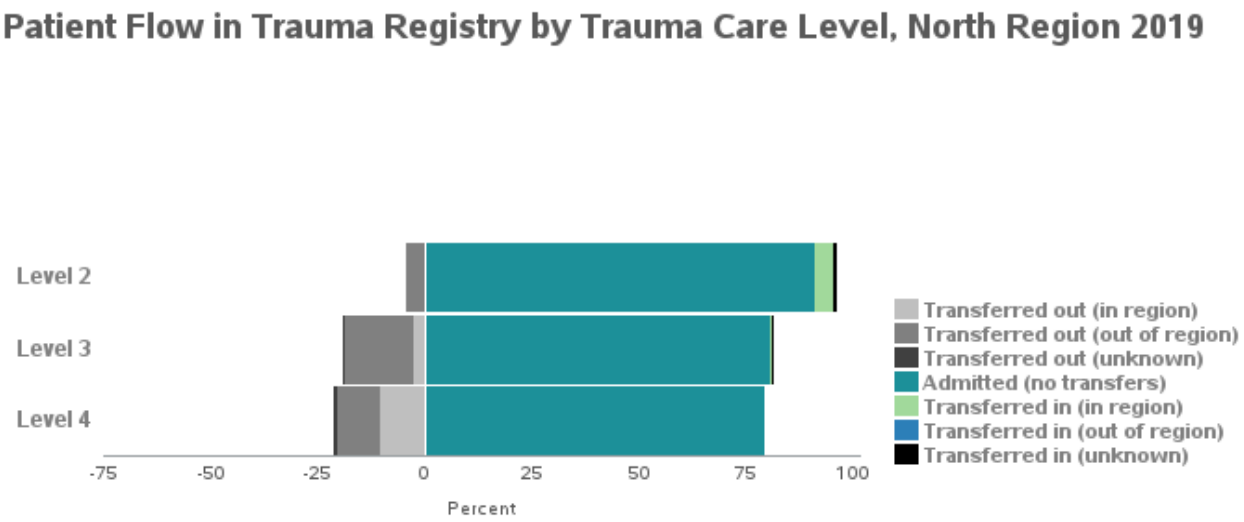

Figure 21 Patient Flow in Trauma Registry by Trauma Level of Care, North Region 2019

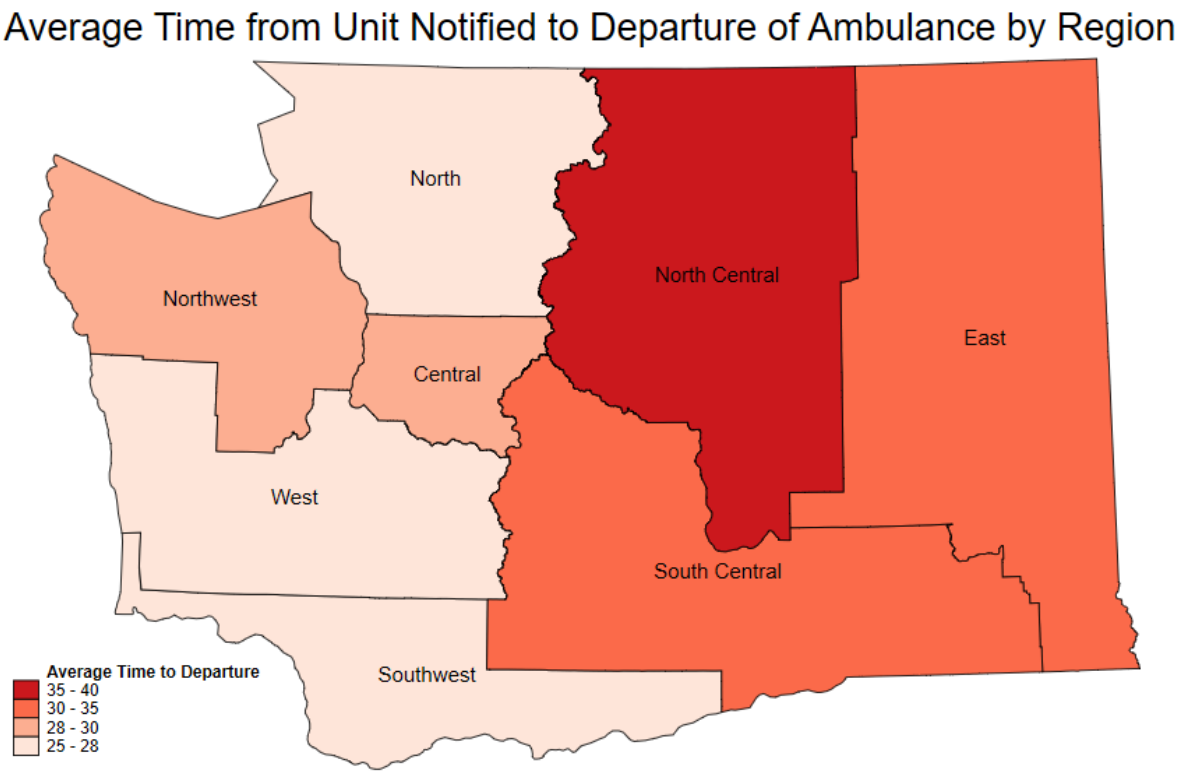

Figure 22 Average Time from EMS Unit Notification to Scene Departure by Region

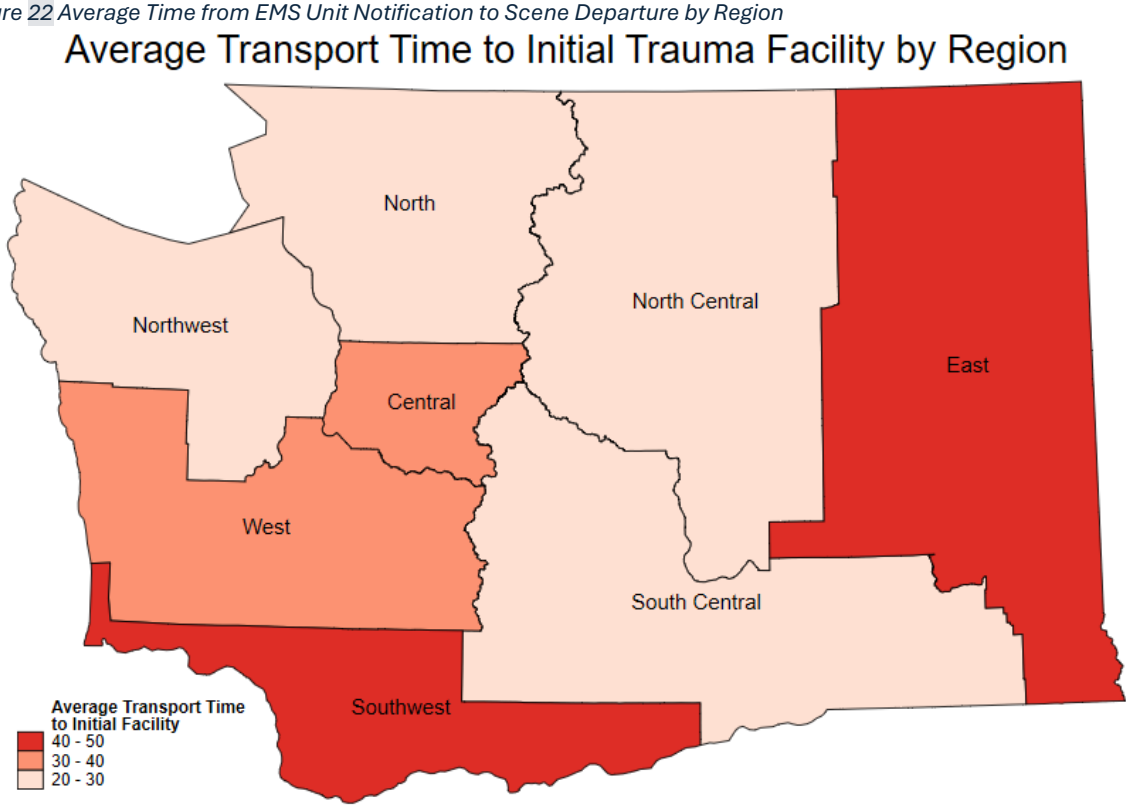

Figure 23 Average Transport Time from Scene Departure to Initial Facility by Region

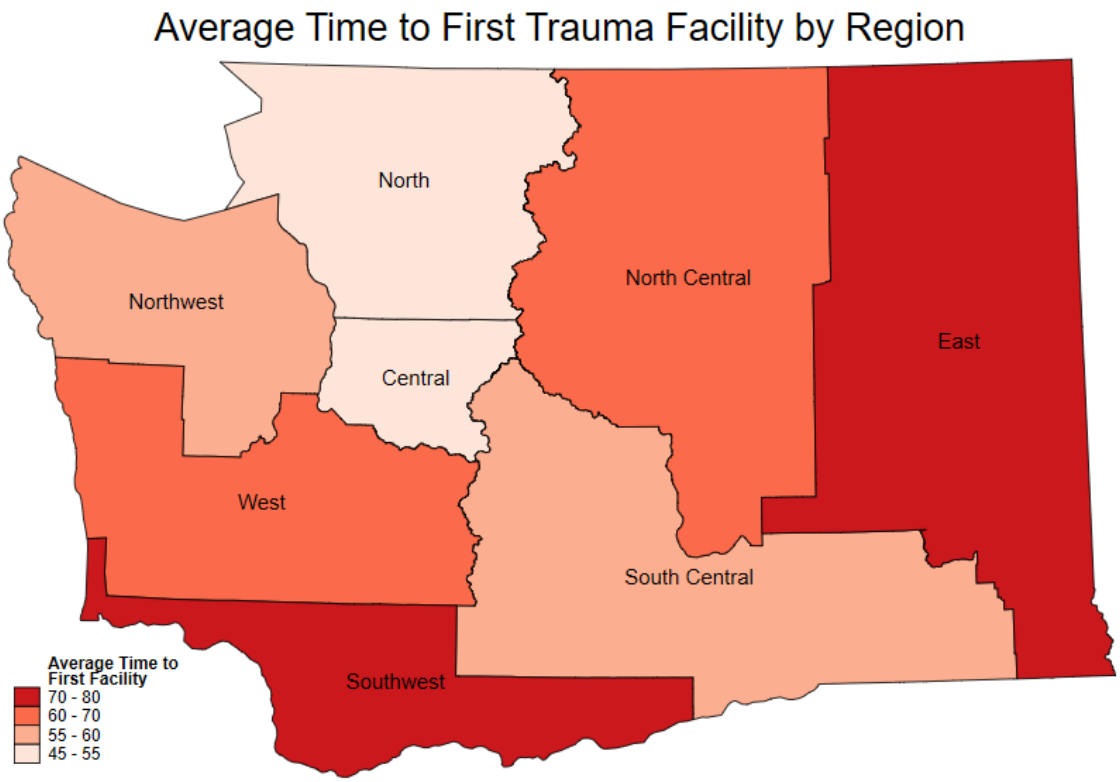

Figure 24 Average Time from EMS Unit Notification to First Trauma Facility by Region

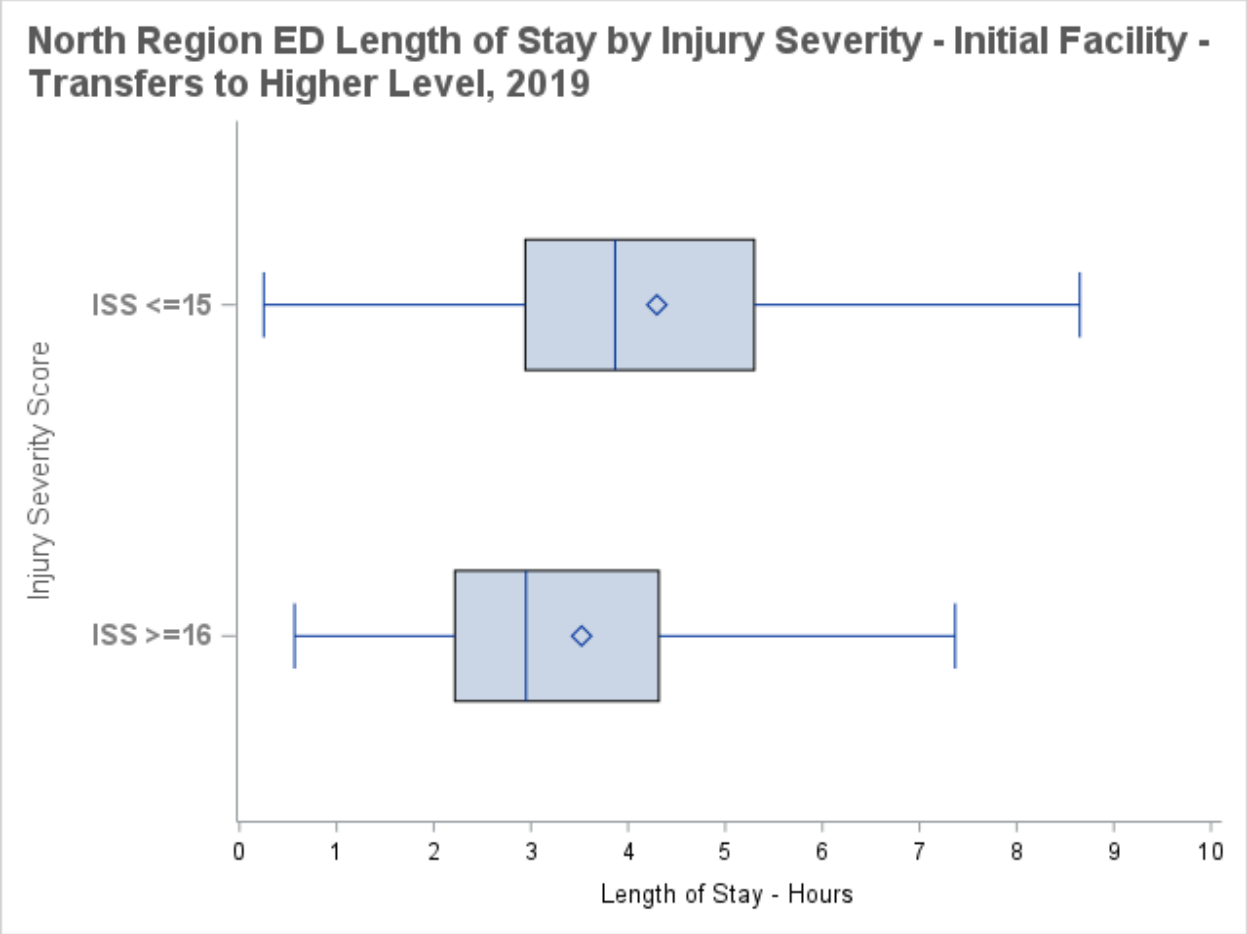

Figure 25 North region Emergency Department Length of Stay at Initial Facility, Patients Transferred to Higher Level of Care, by ISS

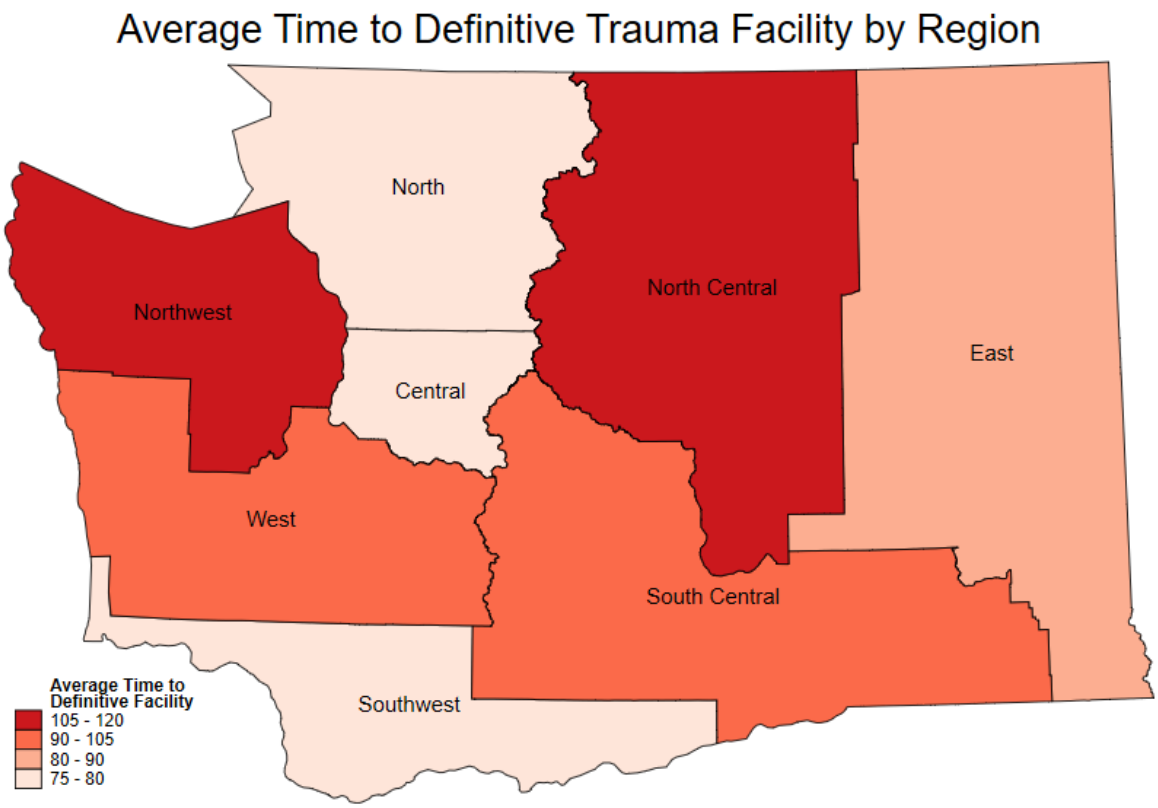

Figure 26 Average Time from EMS Unit Notification to Definitive Trauma Facility by Region

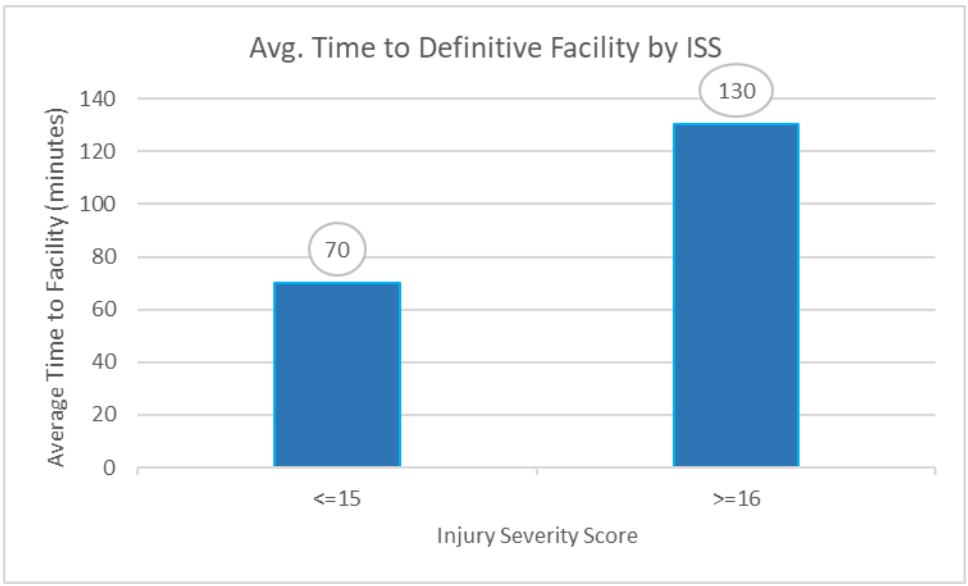

Figure 27 Average Time from EMS Unit Notification to Definitive Trauma Facility by Injury Severity Score, North Region

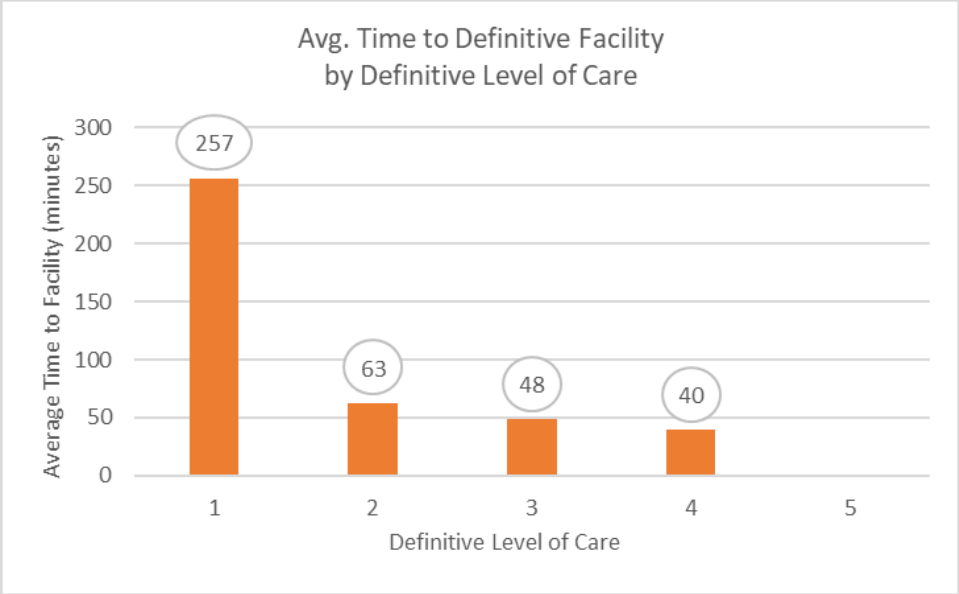

Figure 28 Average Time from EMS Unit Notification to Definitive Care by Level of Definitive Facility, North Region

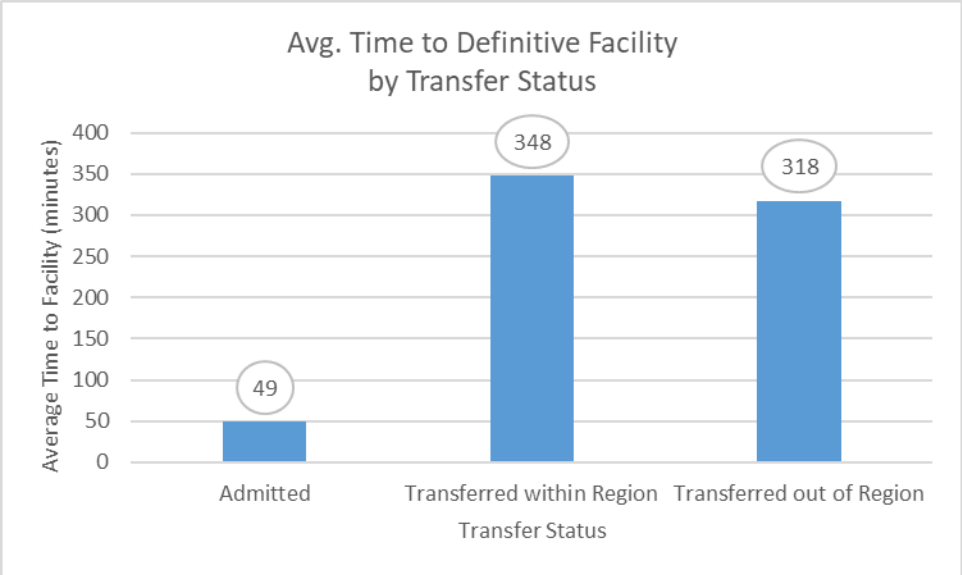

Figure 29 Average Time from EMS Unit Notification to Definitive Facility by Transfer Status, North Region, 2019

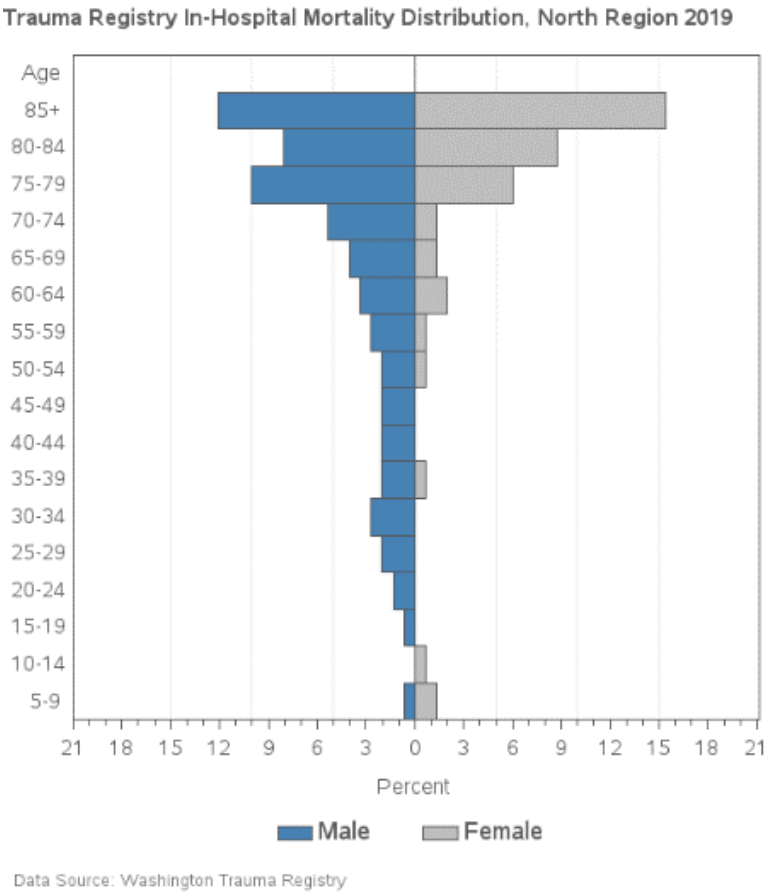

Figure 30 Trauma Registry In-hospital Mortality Distribution, North Region 2019

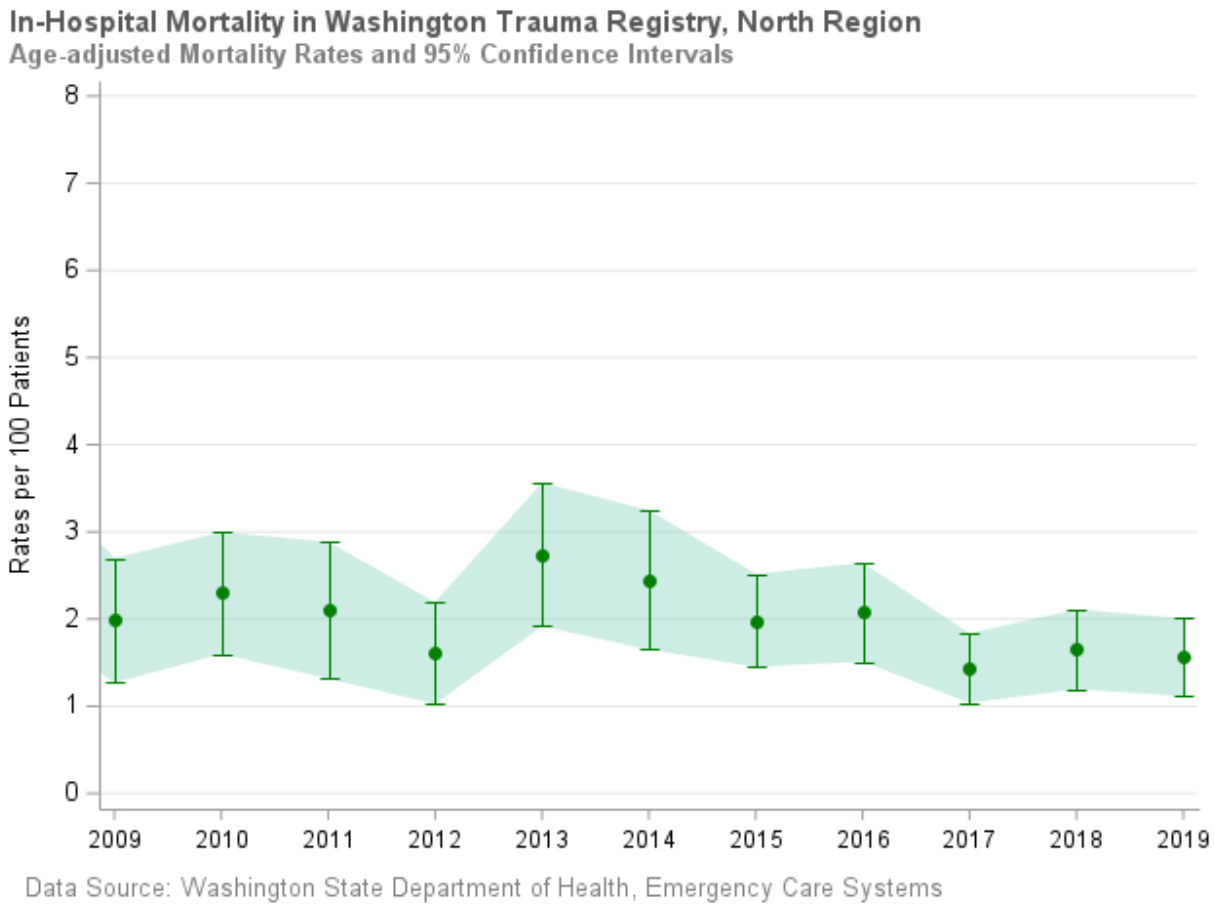

Figure 31 Age-adjusted Mortality Rates in WA Trauma Registry, North Region

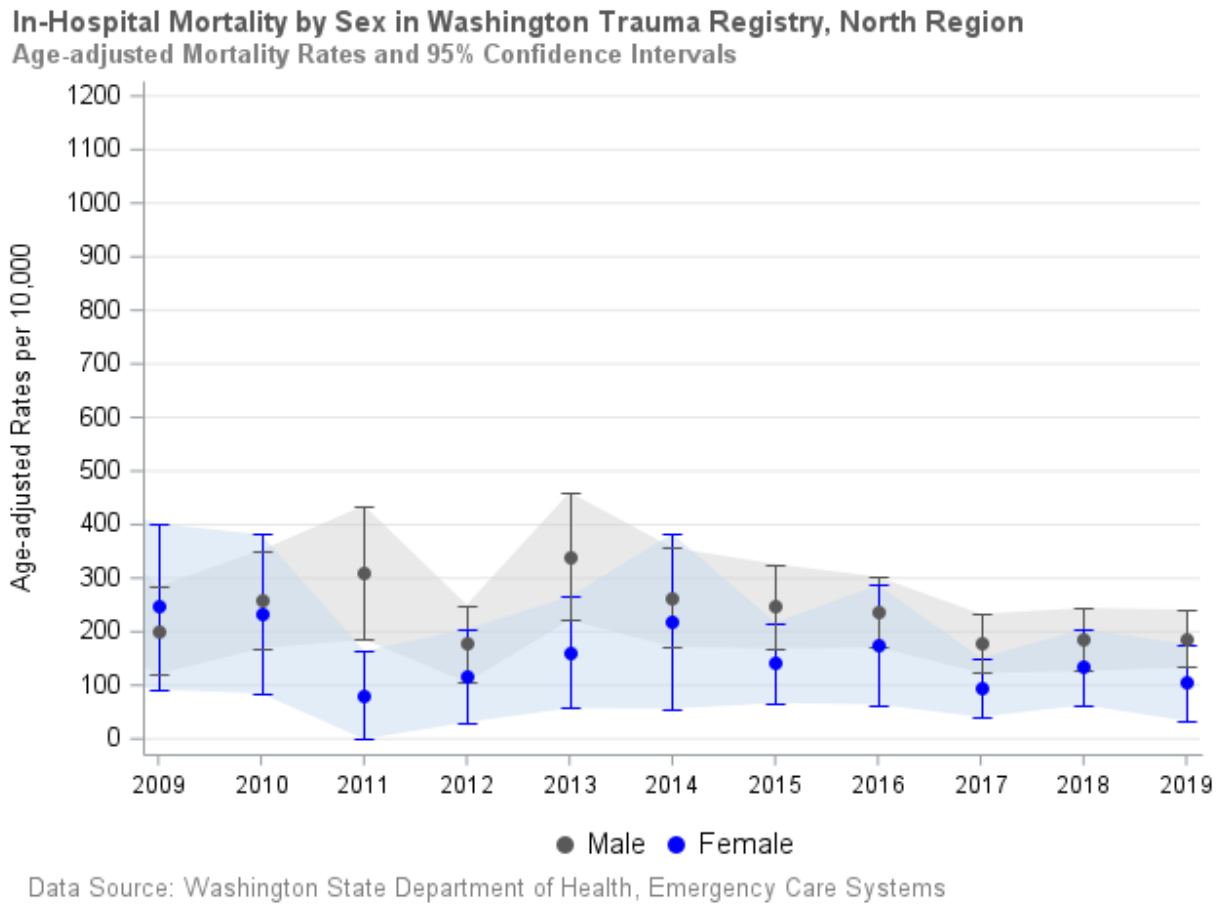

Figure 32 Age-adjusted Mortality Rates in WA Trauma Registry by Sex, North Region

Northwest Region data figures and tables

Projected Percent Change in Population by EMS and Trauma Region

Region	Projected Change 2020-2030
South Central	+15%
State	+10%

Figure 1 Population % Change, 2020-2030, EMS & Trauma Region

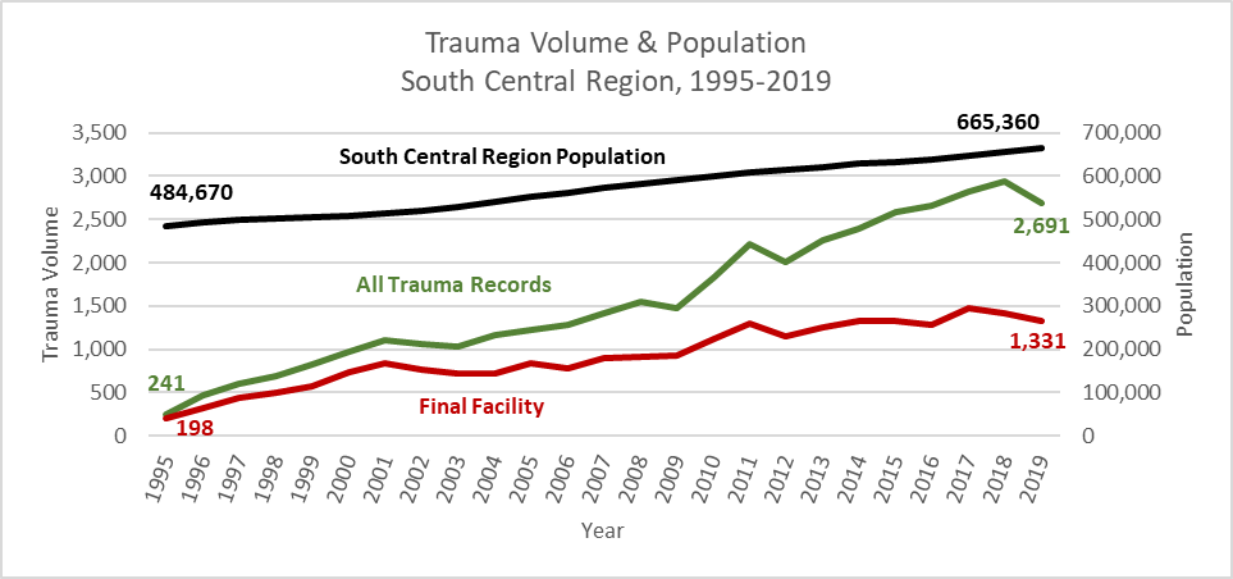

Figure 2 Trauma Volume & Population, South Central Region 1995-2019

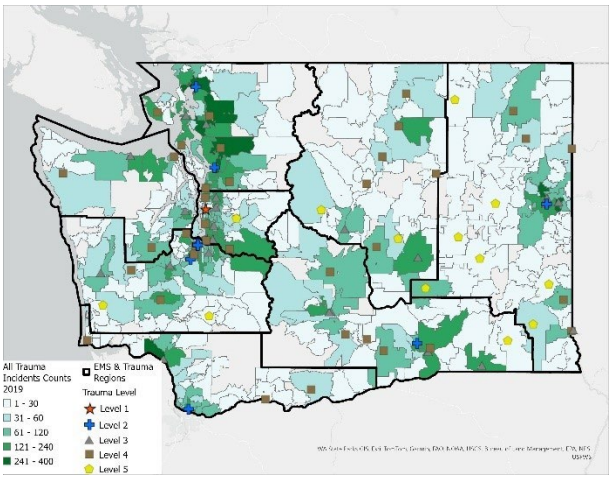

Figure 3 Map of Severe Trauma Distribution by Zip Code, 2019

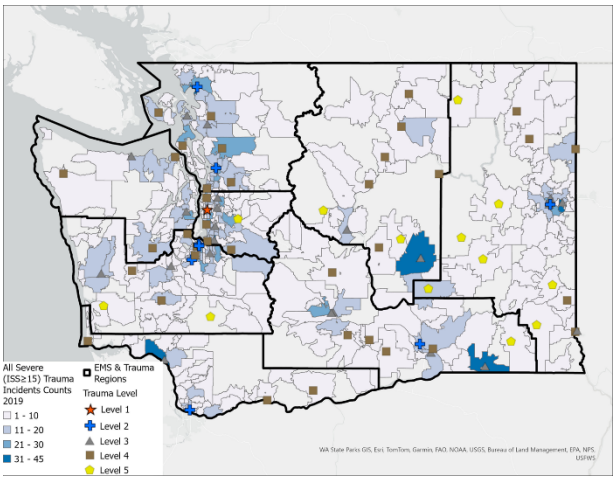

Figure 4 Map of Trauma Distribution by Zip Code, 2019

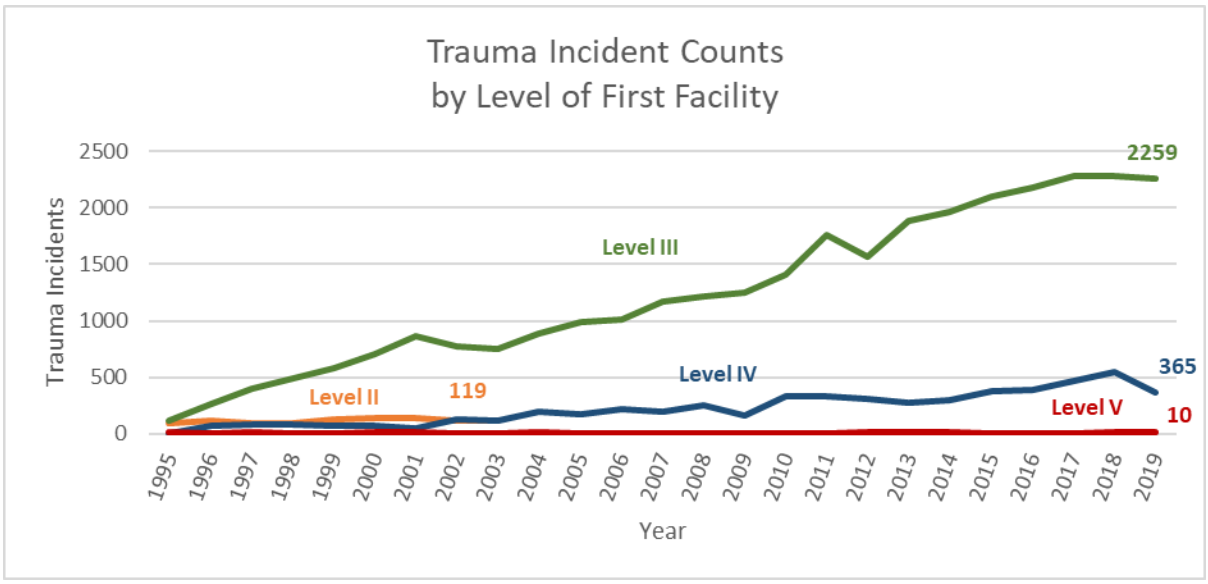

Figure 5 South Central Region Trauma Incident Counts by Level of First Facility, 1995-2019

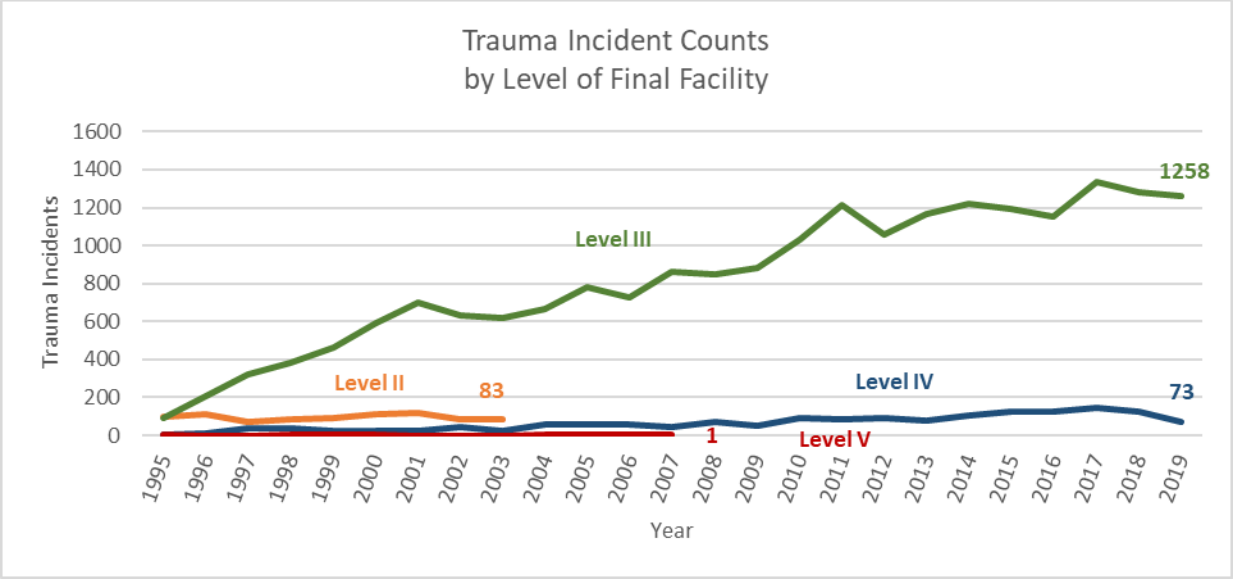

Figure 6 South Central Region Trauma Incident Counts by Level of Final Facility, 1995-2019

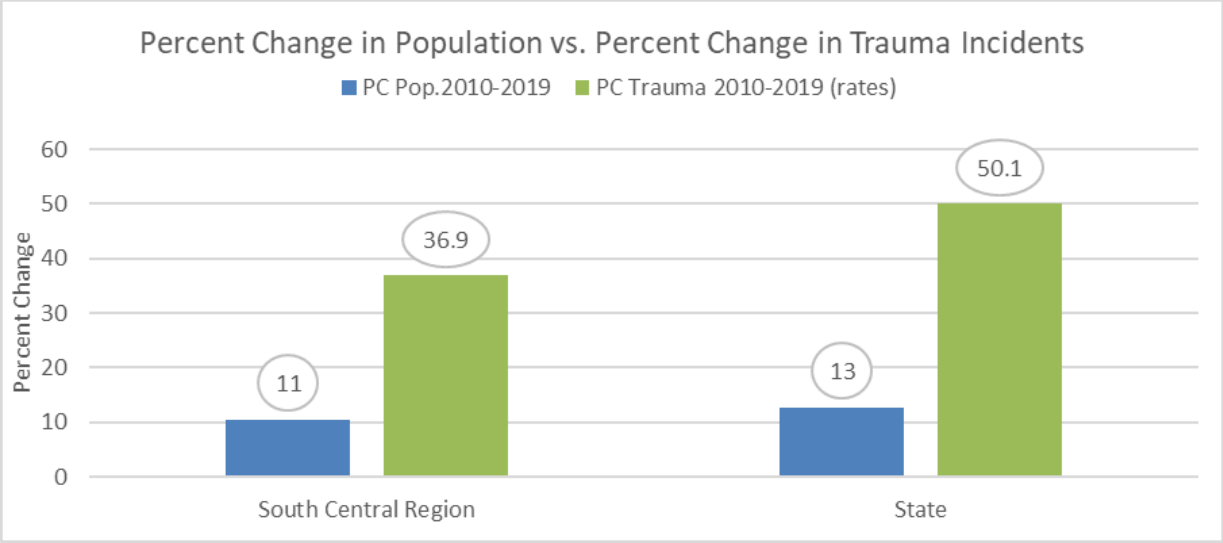

Figure 7 Regional % change in population and trauma incidents, South Central Region vs. State

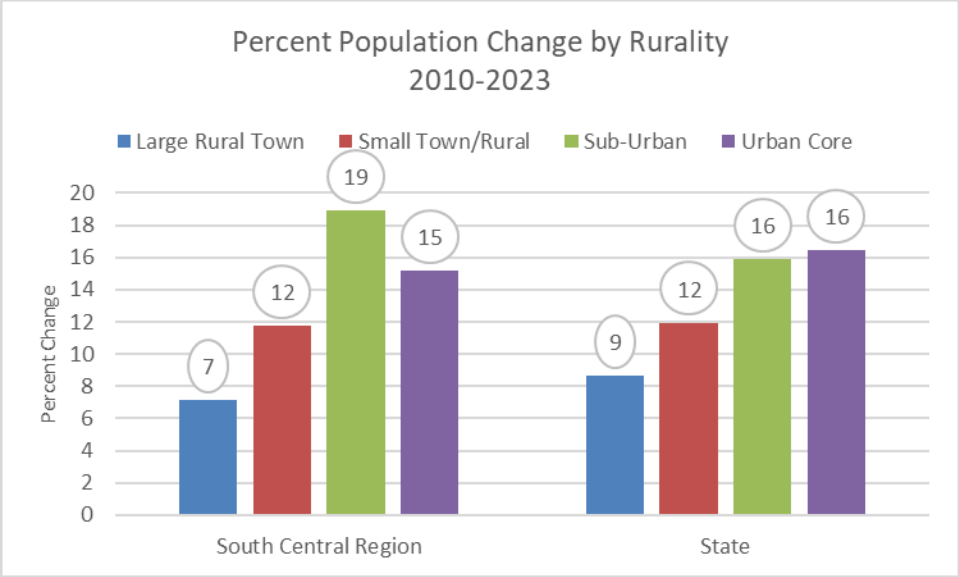

Figure 8 Rurality Population Percent Change, South Central Region vs. State, 2010-2023

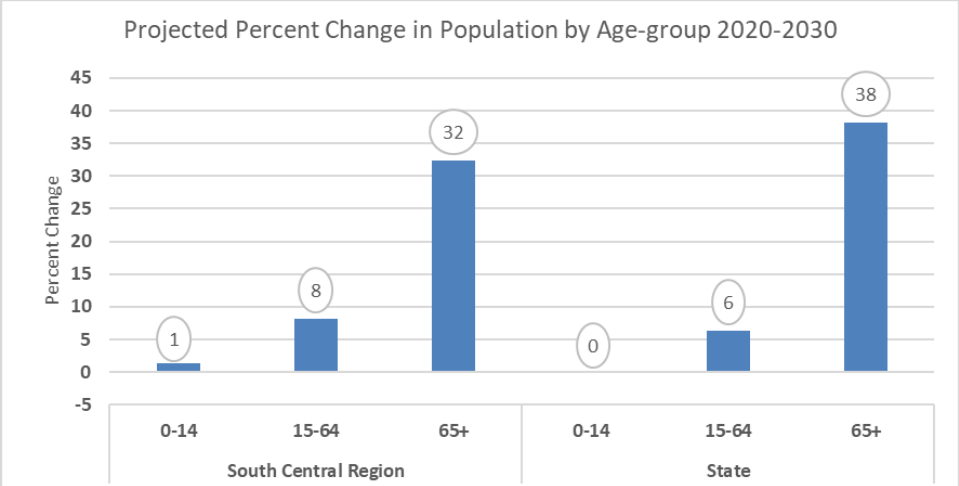

Figure 9 South Central Region vs. State projected population growth 2020-2030

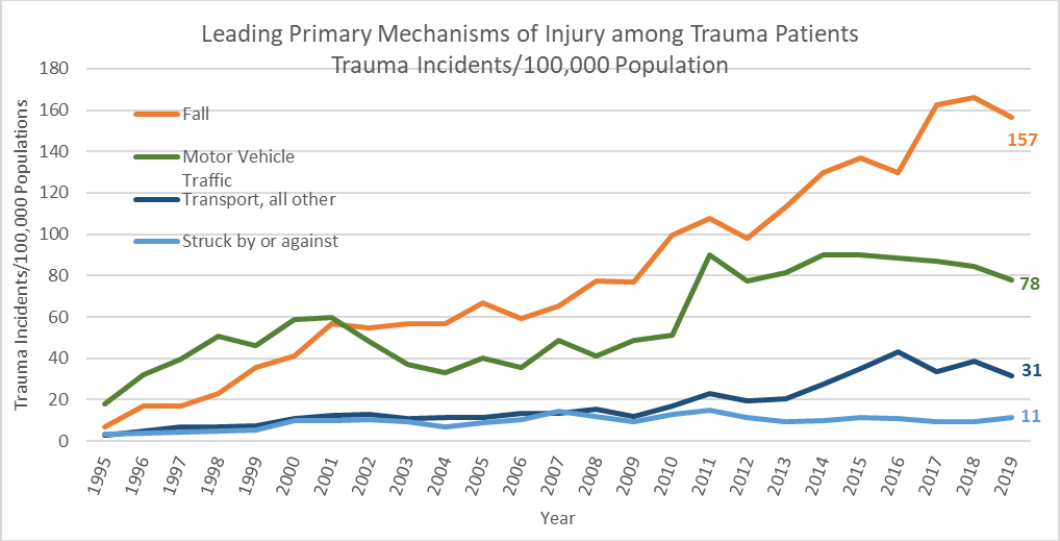

Figure 10 Leading Primary Mechanism of Injury, South Central Region,1995-2019

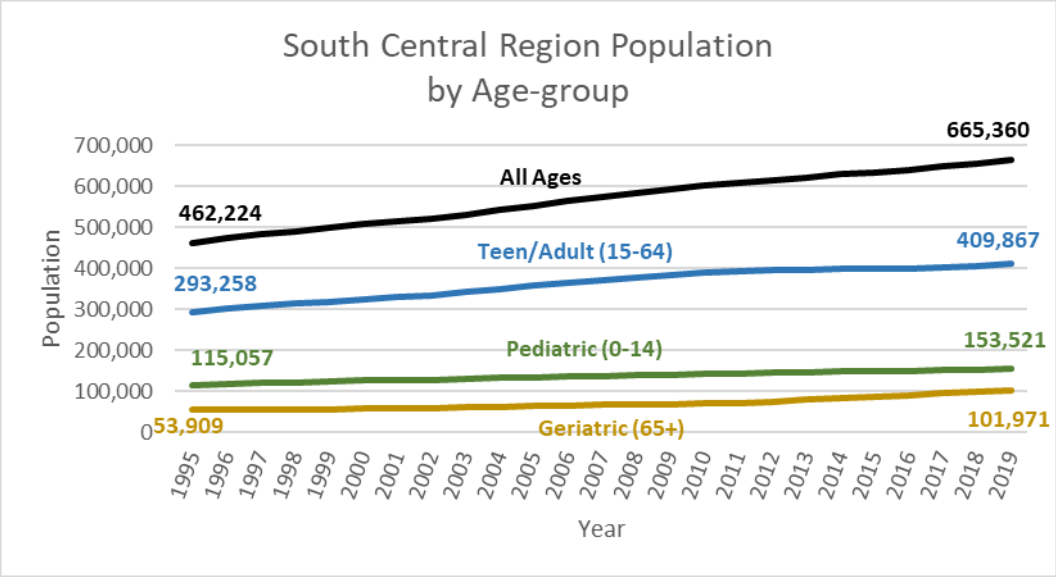

Figure 11 South Central Region Population by Age-group, 1995-2019

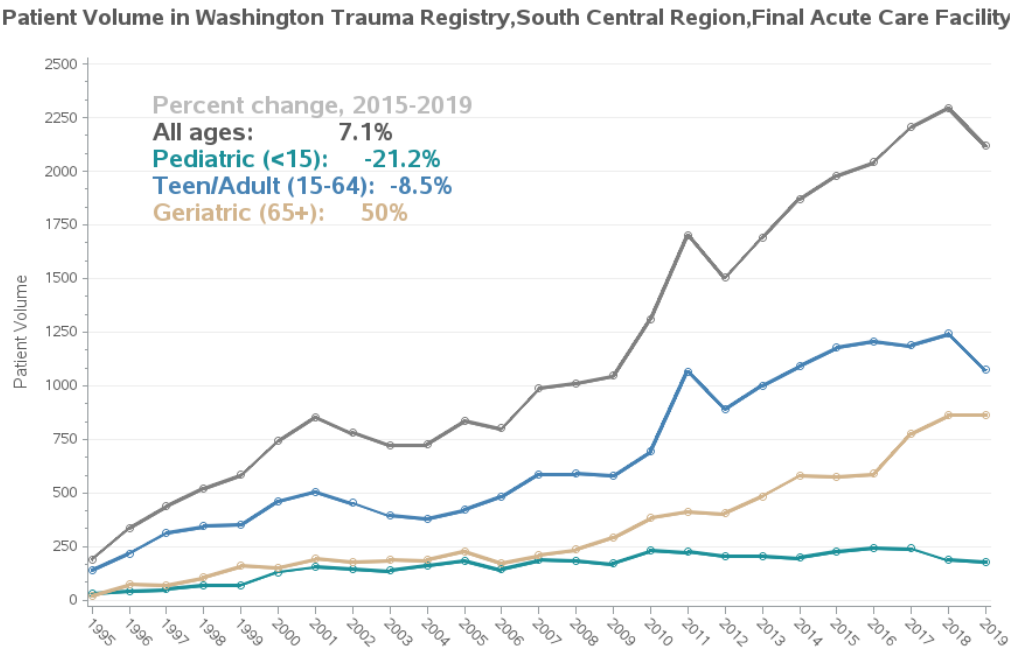

Figure 12 Trauma Volume by Age-group, South Central Region

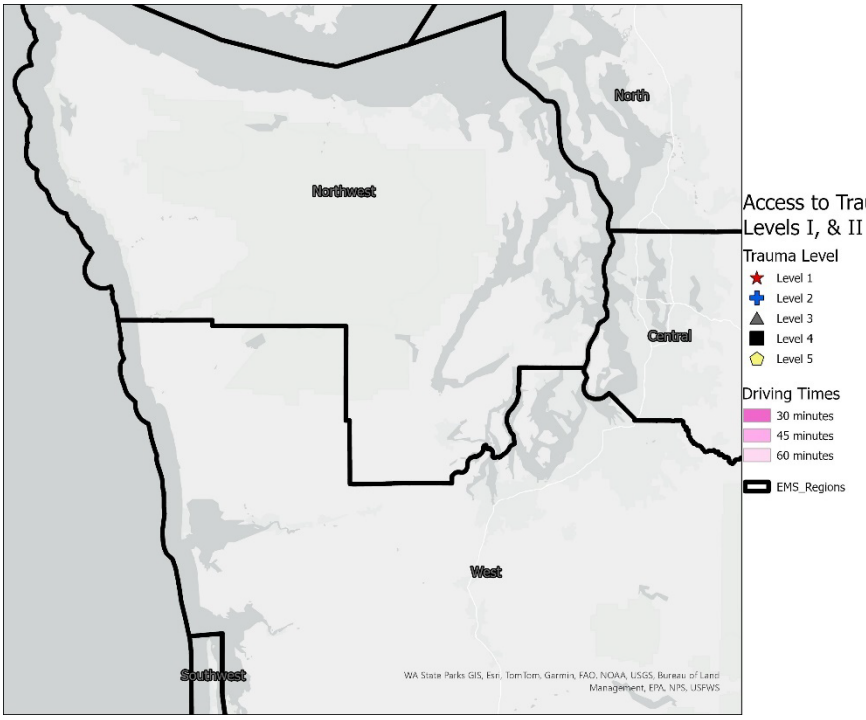

Figure 13 Trauma Levels I &II Driving Times to facilities within Northwest Region

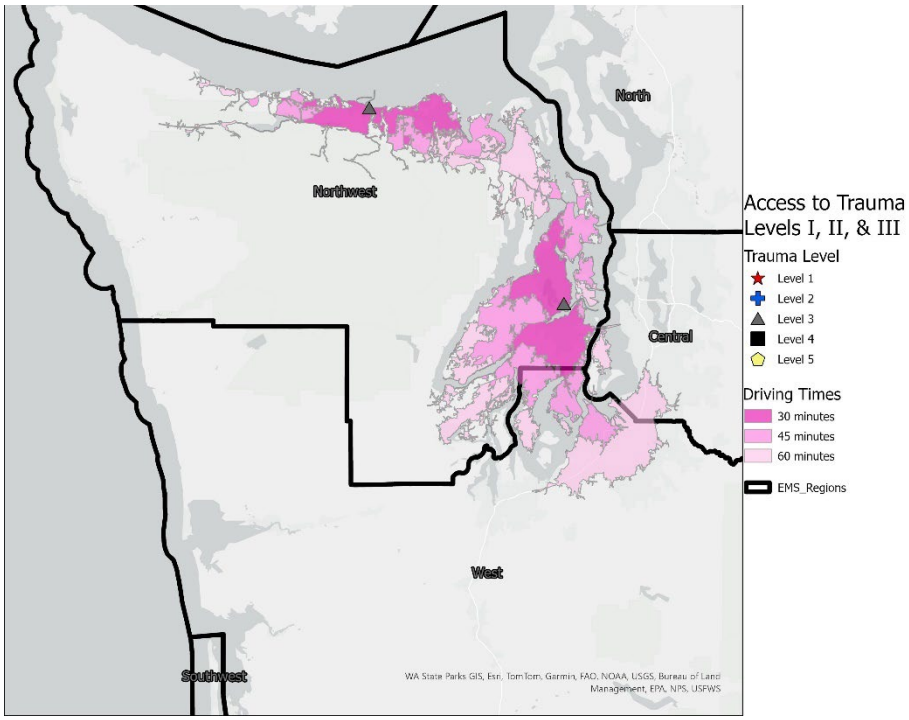

Figure 14 Trauma Levels I, II, & III Driving Times to facilities within Northwest Region

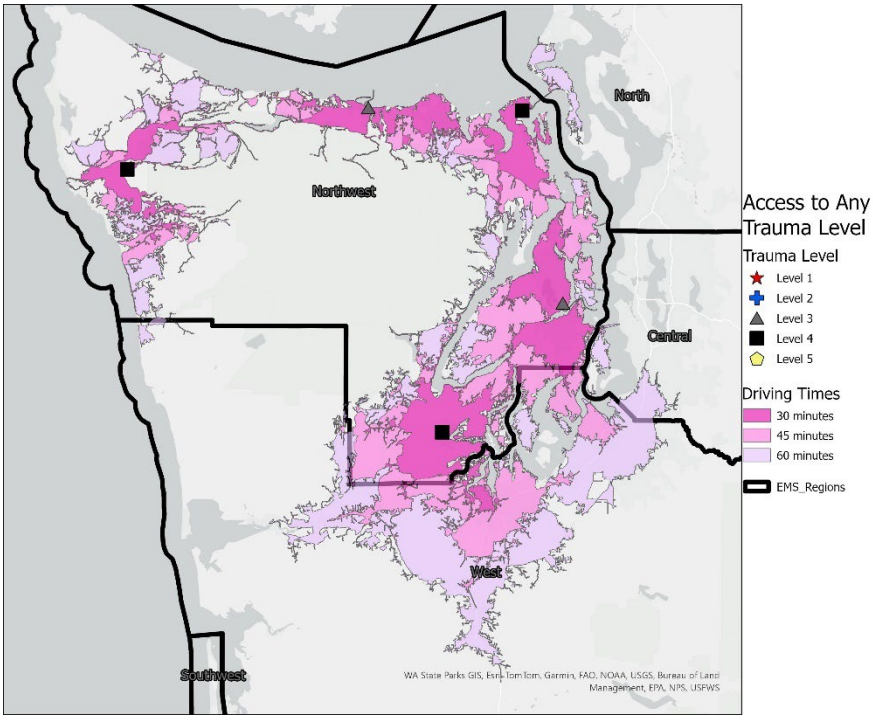

Figure 15 Any Trauma Level Driving Times to facilities within Northwest Region

Population within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
South Central	≤30 min%	38%	78%	96%
	≤45 min%	46%	92%	98%
	≤60 min%	53%	98%	99%

Figure 16 South Central Region population within driving distances to trauma center

Percent of trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
South Central	≤30 min%	33%	84%	95%
	≤45 min%	38%	93%	98%
	≤60 min%	42%	98%	99%

Figure 17 South Central Region trauma incidents within driving distances to trauma centers

Percent of Severe Trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
South Central	≤30 min%	18%	79%	95%
	≤45 min%	22%	94%	99%
	≤60 min%	32%	97%	99%

Figure 18 South Central Region severe trauma incidents within driving distances to trauma centers

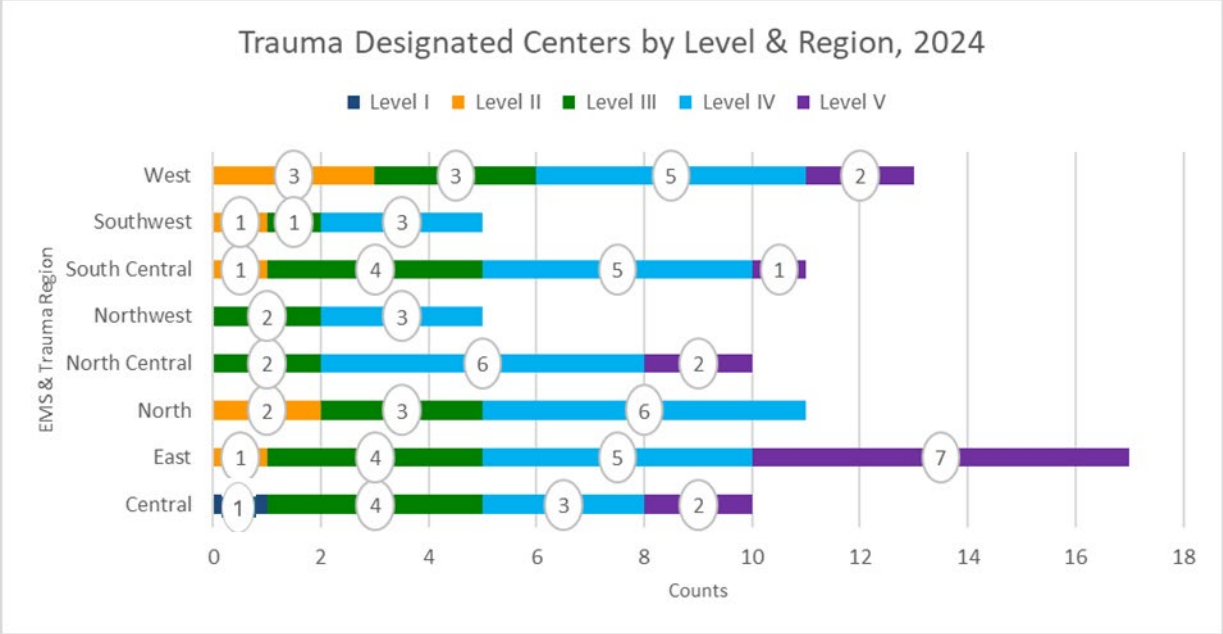

Figure 19 Trauma Designated Centers by Level & Region, 2024

Trauma Patients Initial and Highest Designated Level of Care (%), South Central Region, 2019

		Highest Level of Care				
		Level I	Level II	Level III	Level IV	Level V
Initial Level of Care	Level I	100%	-	-	-	-
	Level II	-	100%	-	-	-
	Level III	15%	6%	79%	-	-
	Level IV	22%	7%	9%	62%	-
	Level V	10%	10%	20%	-	60%

Figure 20 Trauma Patients Initial & Highest Designated Level of Care (%), South Central Region, 2019

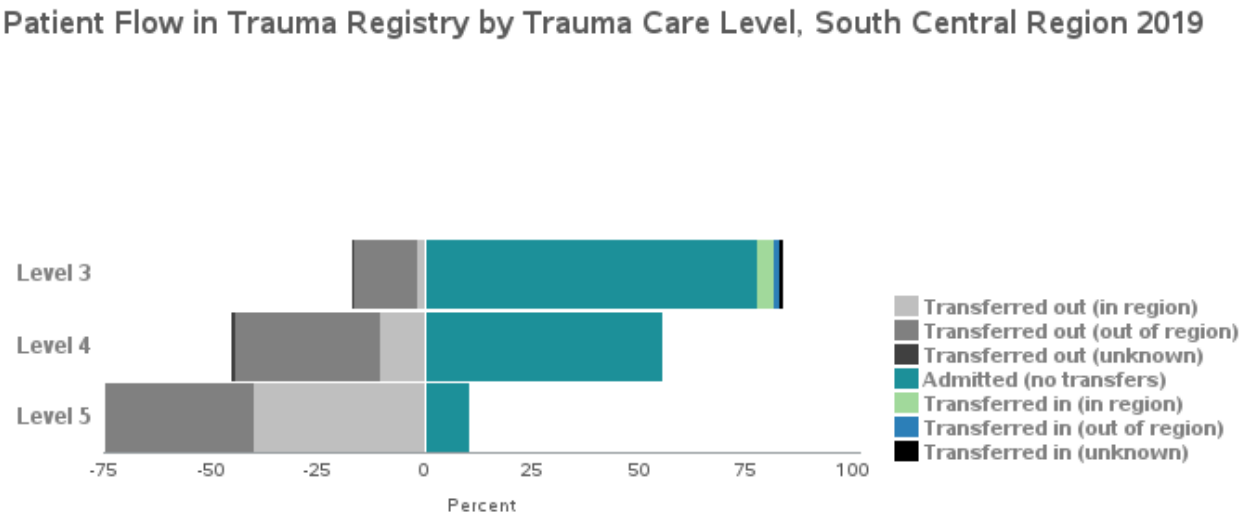

Figure 21 Patient Flow in Trauma Registry by Trauma Level of Care, South Central Region 2019

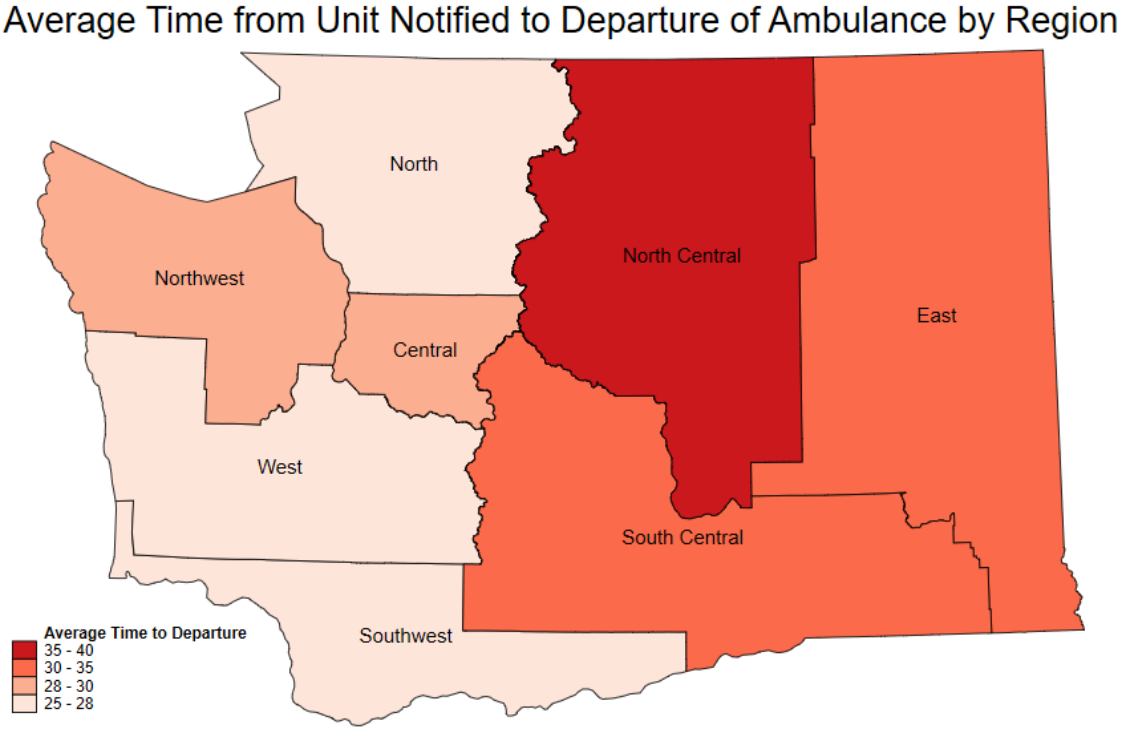

Figure 22 Average Time from EMS Unit Notification to Scene Departure by Region

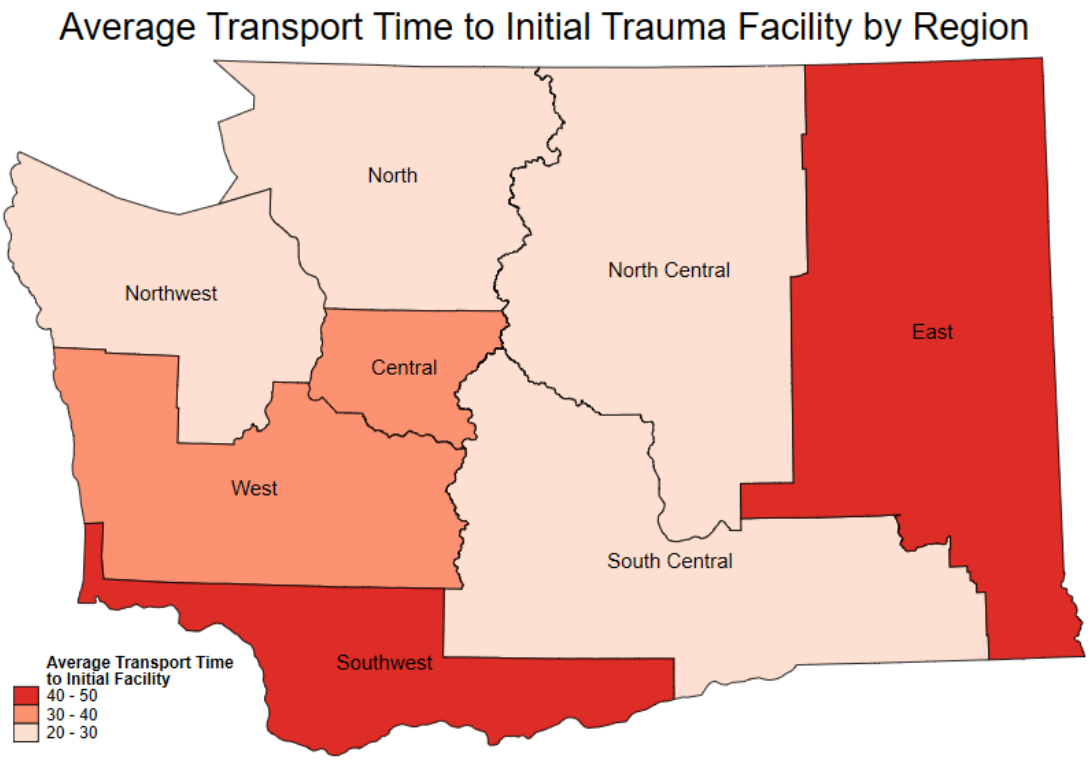

Figure 23 Average Transport Time from Scene Departure to Initial Facility by Region

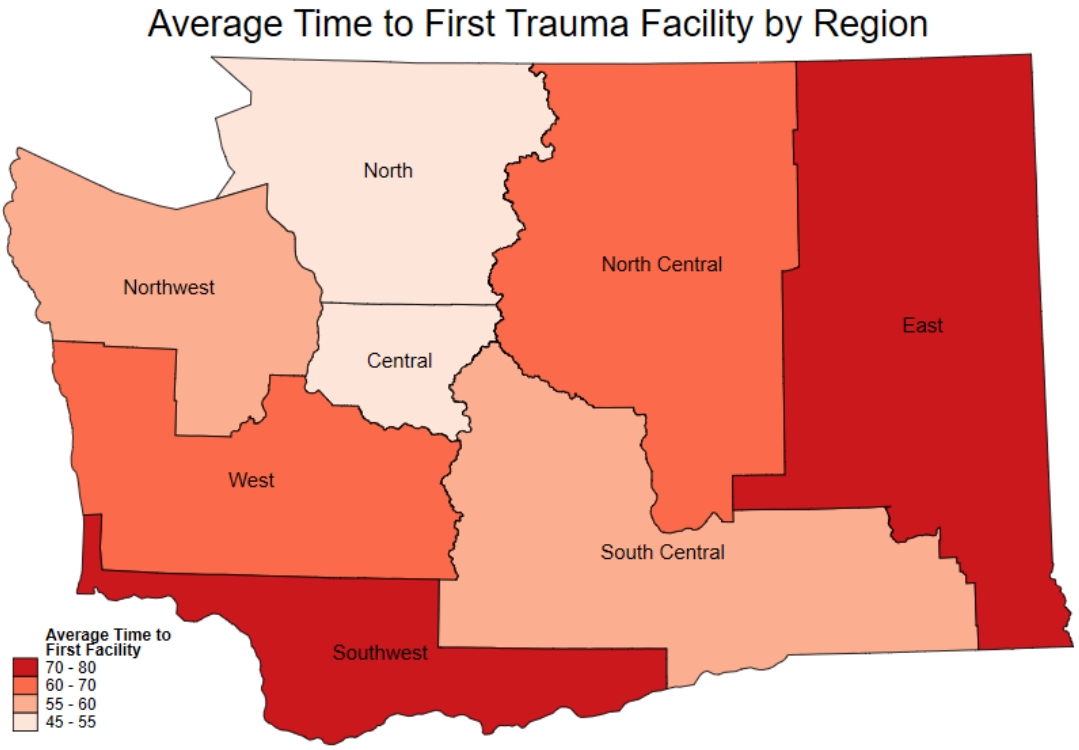

Figure 24 Average Time from EMS Unit Notification to First Trauma Facility by Region

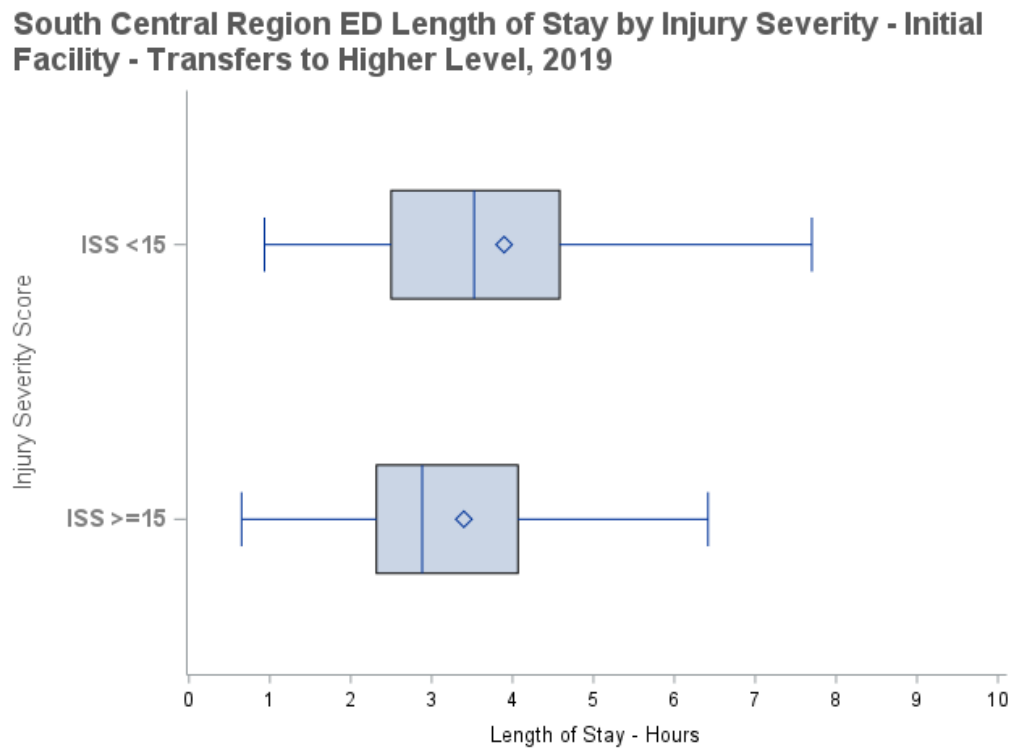

Figure 25 South Central region Emergency Department Length of Stay at Initial Facility, Patients Transferred to Higher Level of Care, by ISS

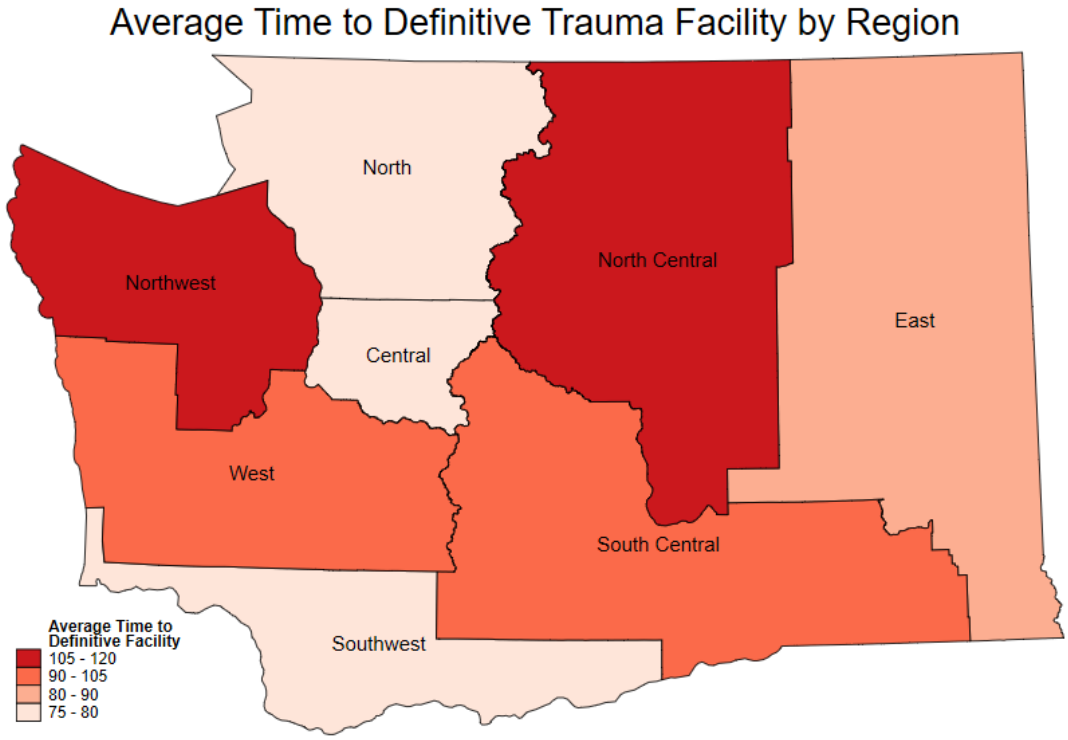

Figure 26 Average Time from EMS Unit Notification to Definitive Trauma Facility by Region

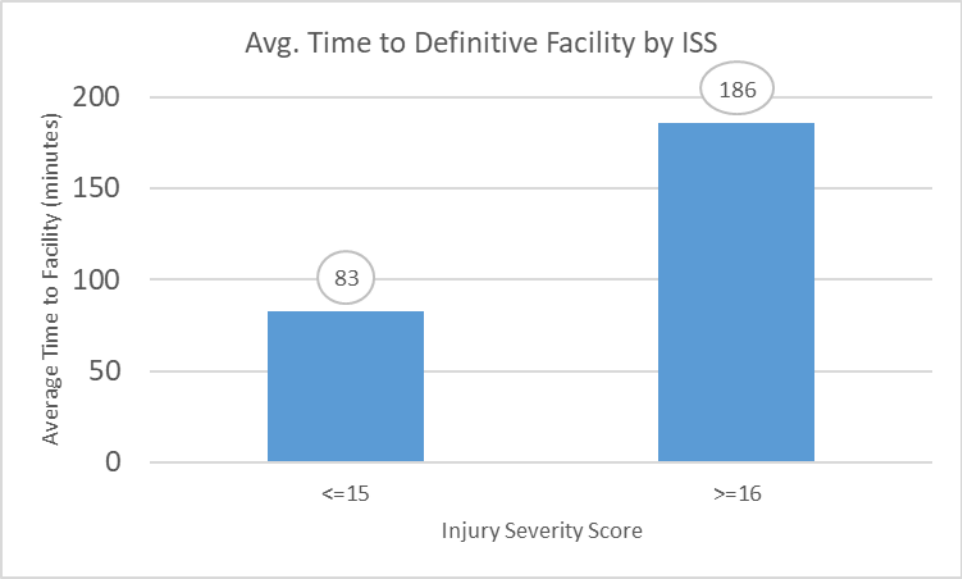

Figure 27 Average Time to Definitive Trauma Facility by Injury Severity Score, South Central Region

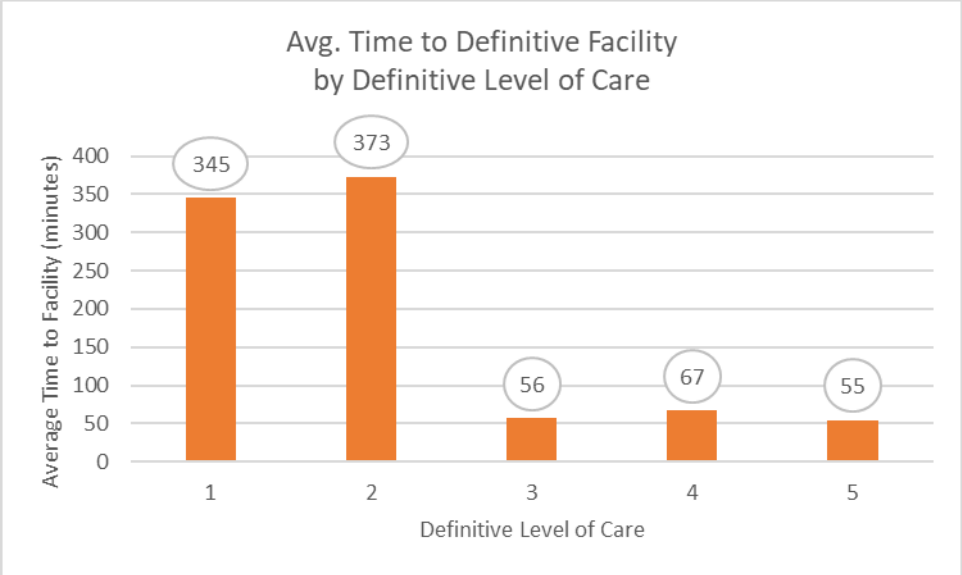

Figure 28 Average Time to Definitive Care by Level of Definitive Facility, Central Region

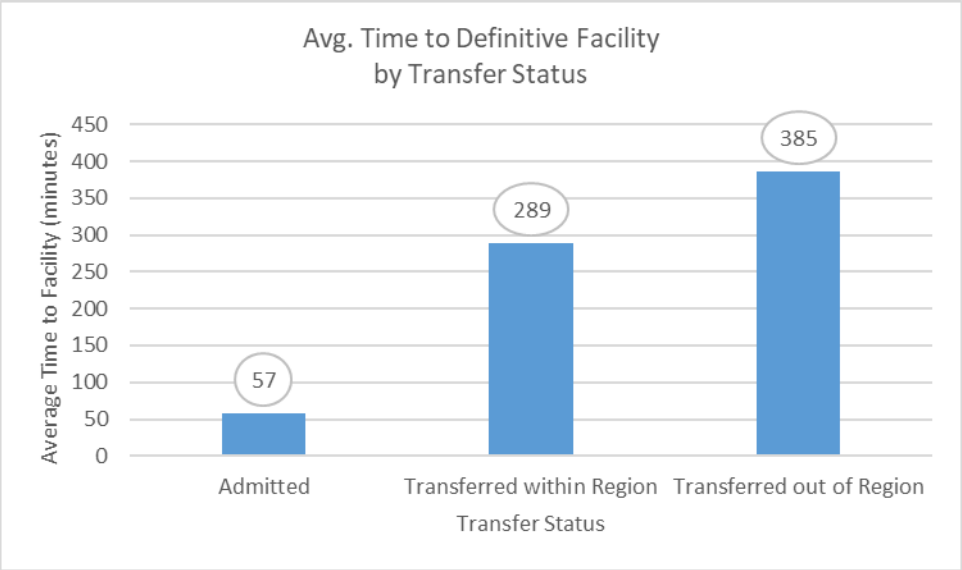

Figure 29 Average Time from EMS Unit Notification to Definitive Facility by Transfer Status, South Central Region, 2019

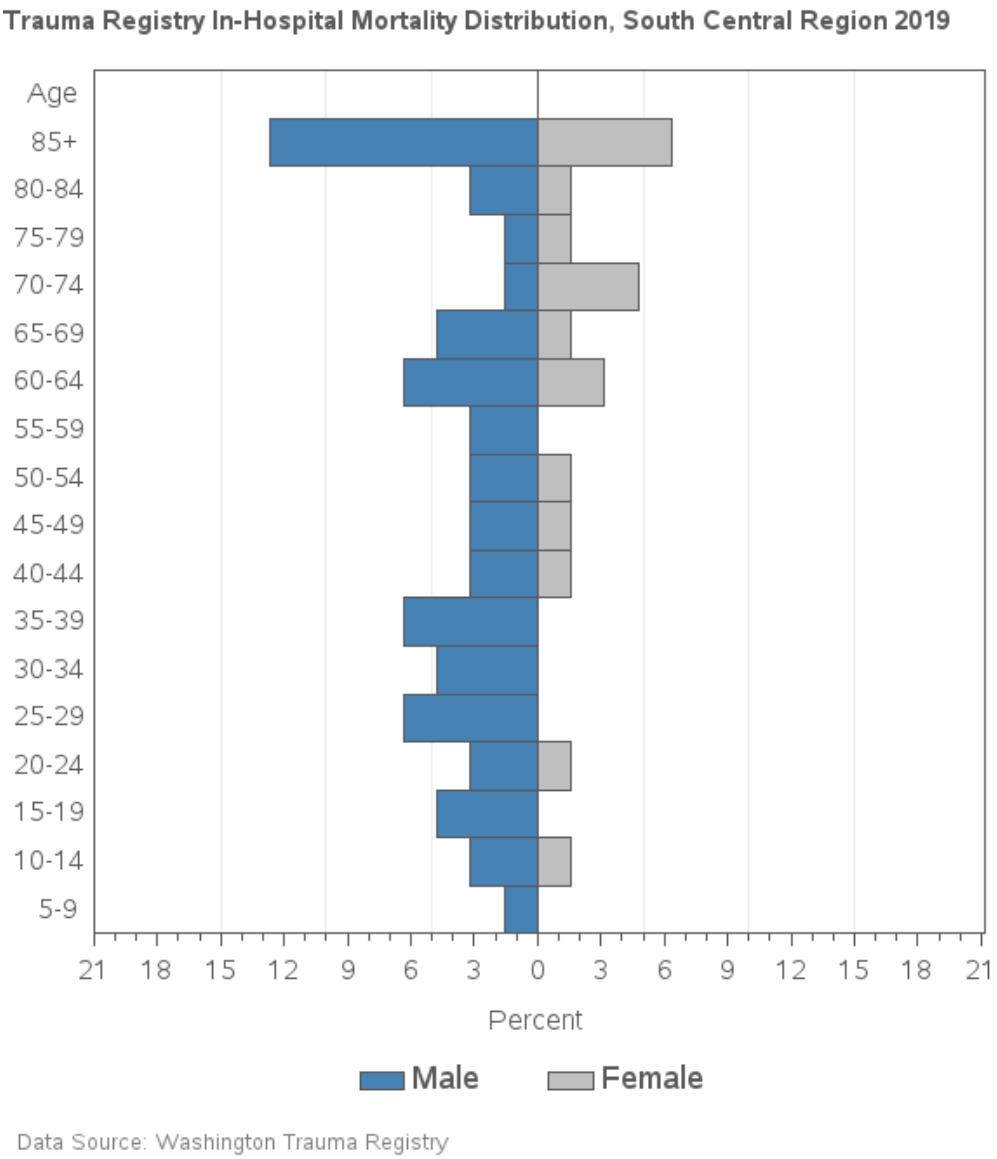

Figure 30 Trauma Registry In-hospital Mortality Distribution, South Central Region 2019

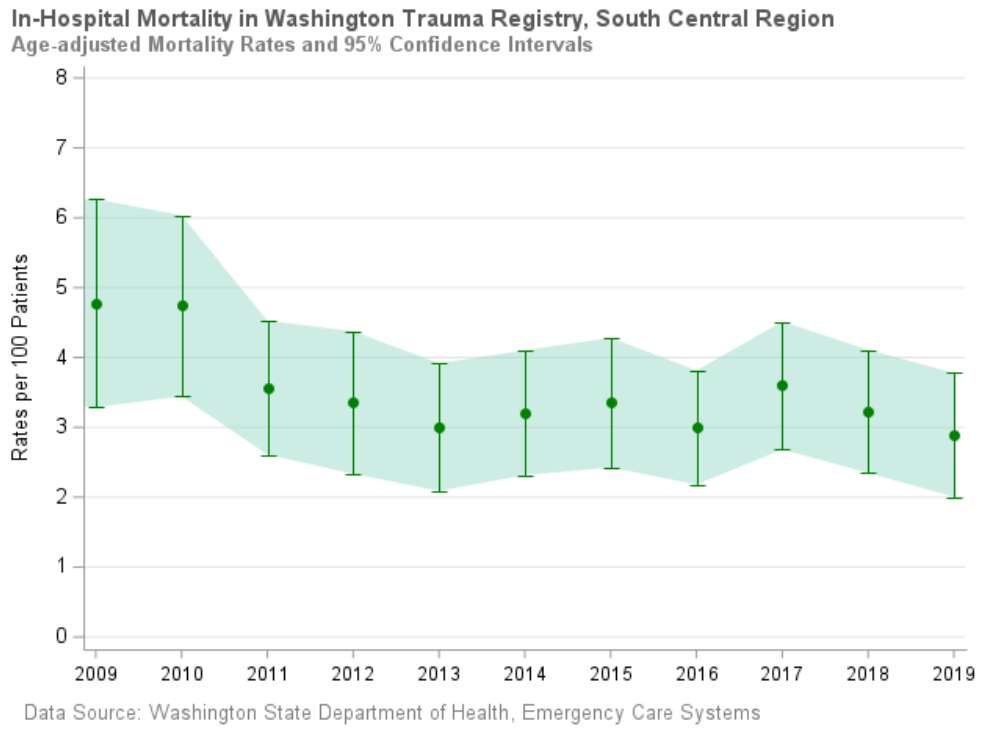

Figure 31 Age-adjusted Mortality Rates in WA Trauma Registry, South Central Region

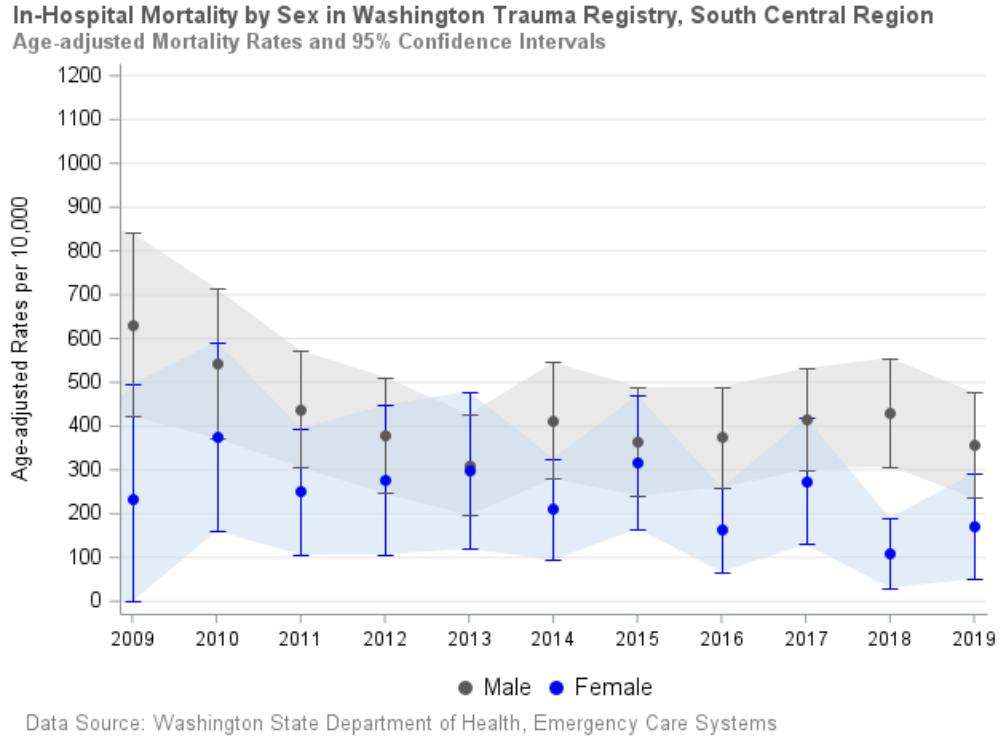

Figure 32 Age-adjusted Mortality Rates by Sex in WA Trauma Registry, South Central Region

North Central Region data figures and tables

Projected Percent Change in Population by EMS and Trauma Region

Region	Projected Change 2020-2030
North Central	+13%
State	+10%

Figure 1 Population % Change, 2020-2030, EMS & Trauma Region

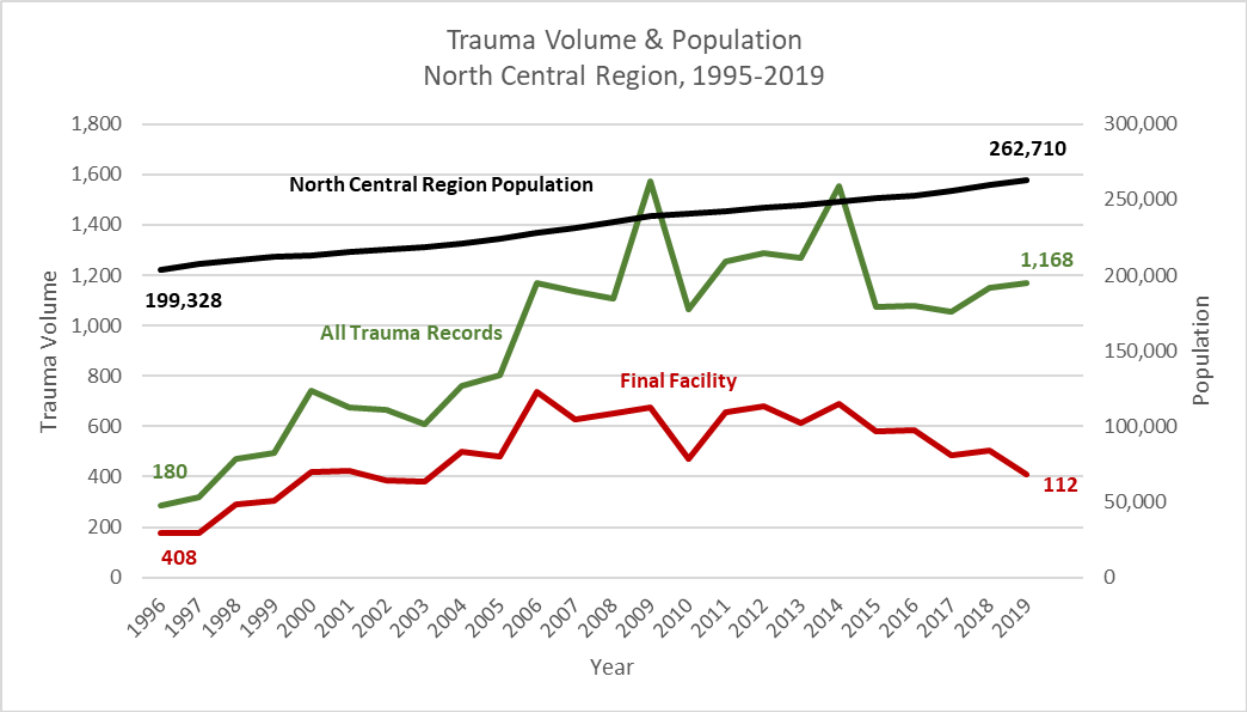

Figure 2 Trauma Volume & Population, North Central Region 1995-2019

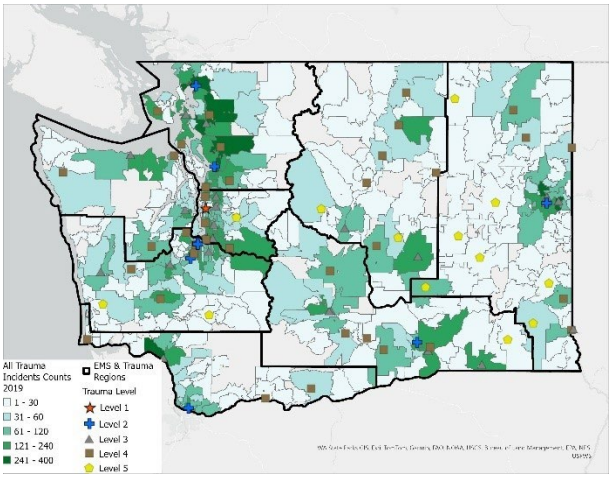

Figure 3 Map of Severe Trauma Distribution by Zip Code, 2019

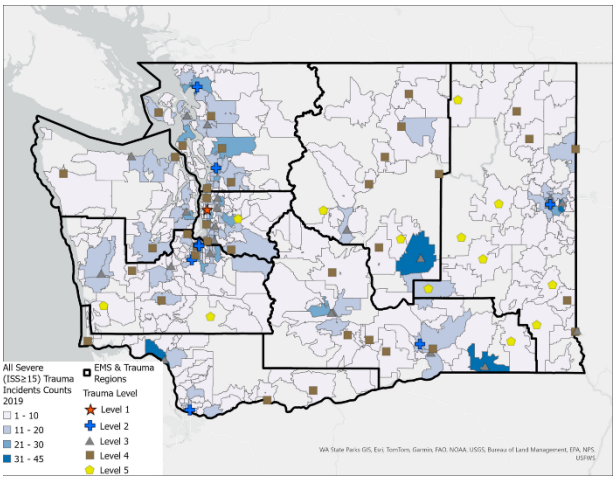

Figure 4 Map of Trauma Distribution by Zip Code, 2019

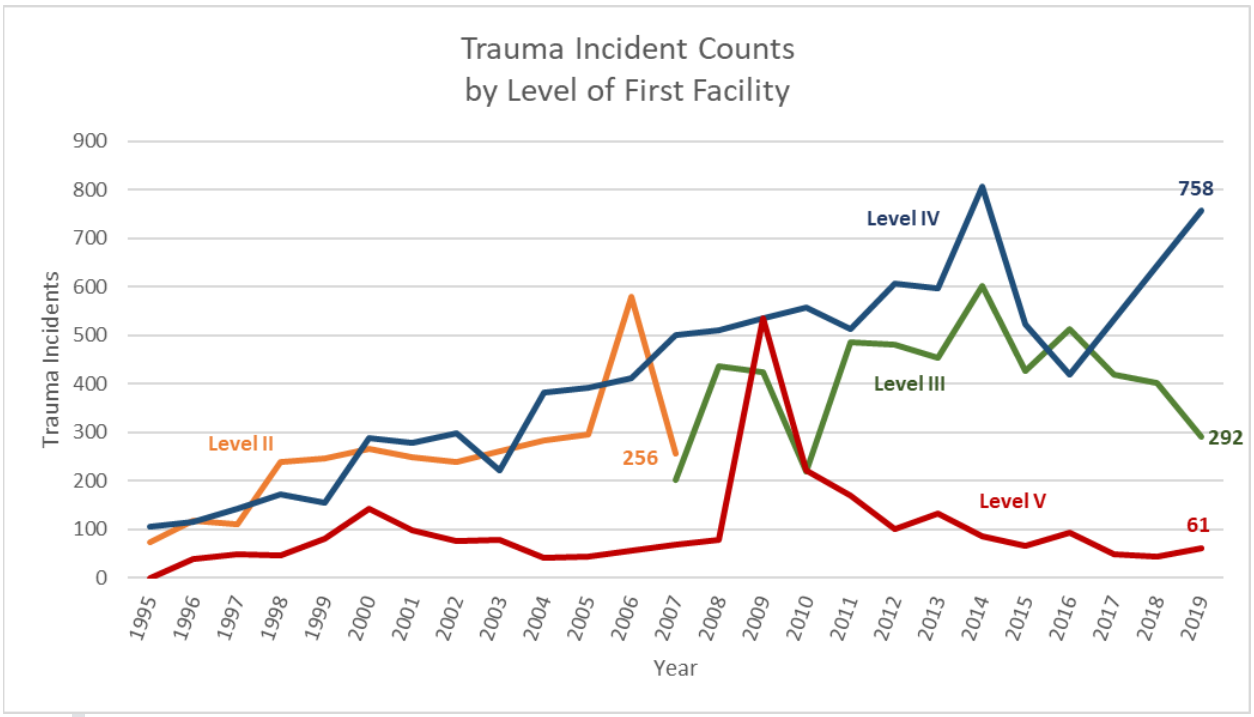

Figure 5 North Central Region Trauma Incident Counts by Level of First Facility, 1995-2019

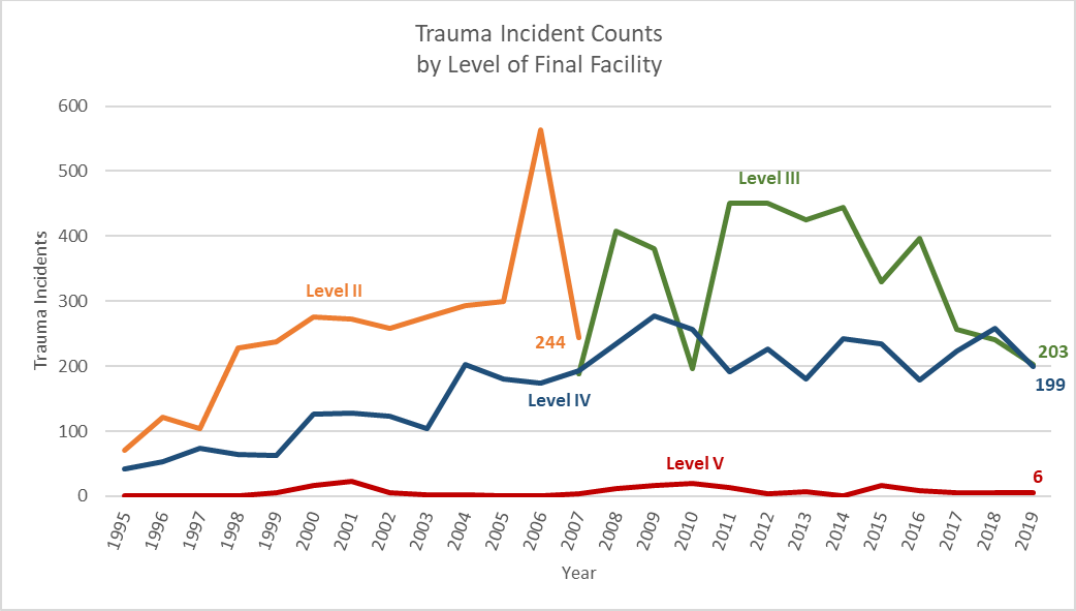

Figure 6 North Central Region Trauma Incident Counts by Level of Final Facility, 1995-2019

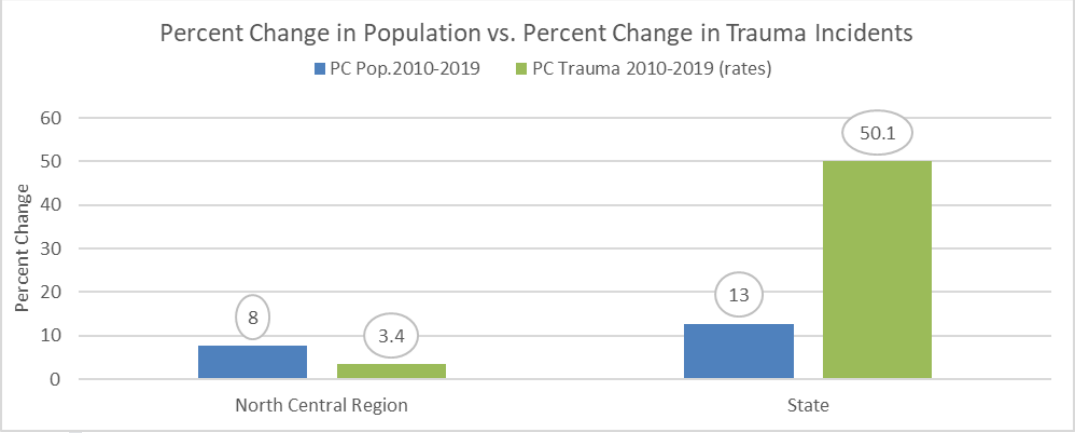

Figure 7 Regional % change in population and trauma incidents, North Central Region vs. State

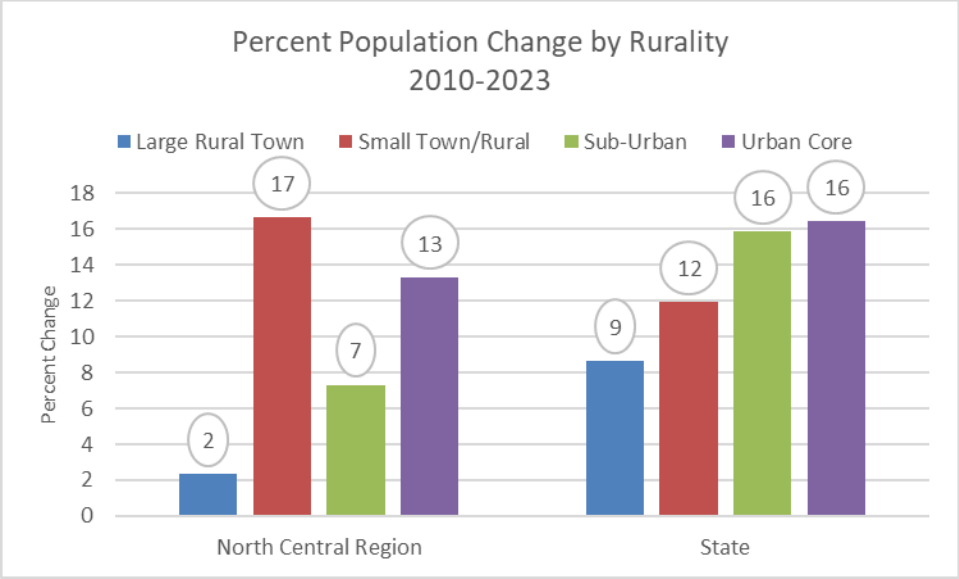

Figure 8 Rurality Population Percent Change, North Central Region vs. State, 2010-2023

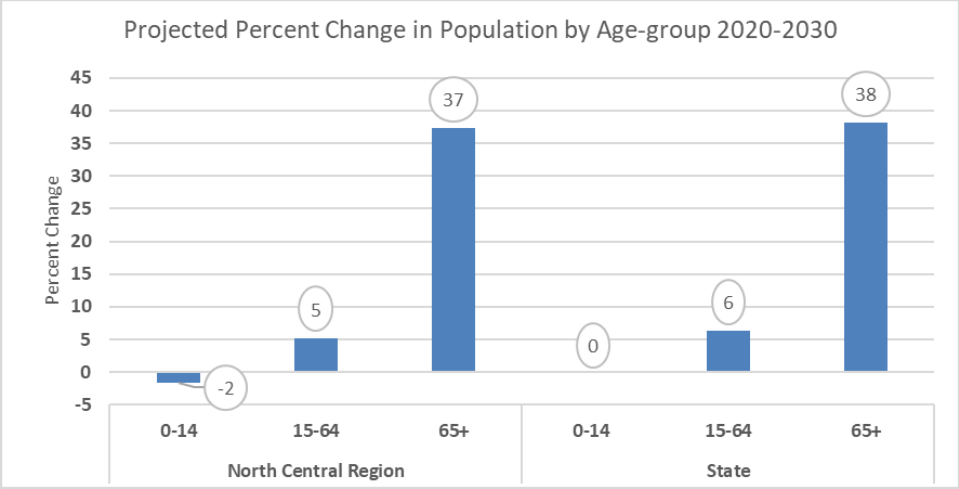

Figure 9 North Central Region vs. State projected population growth 2020-2030

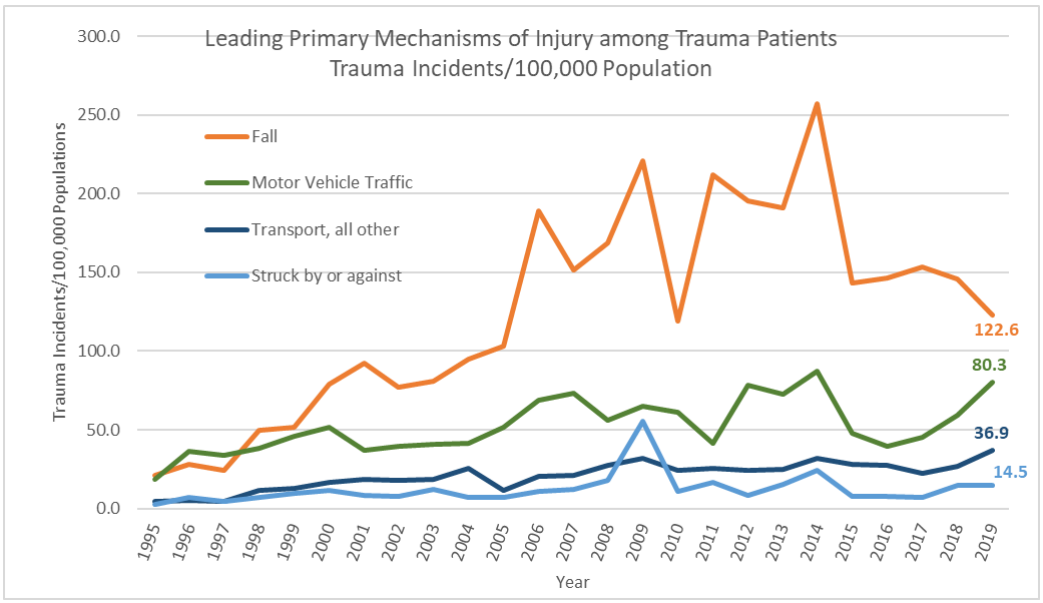

Figure 10 Leading Primary Mechanism of Injury, North Central Region,1995-2019

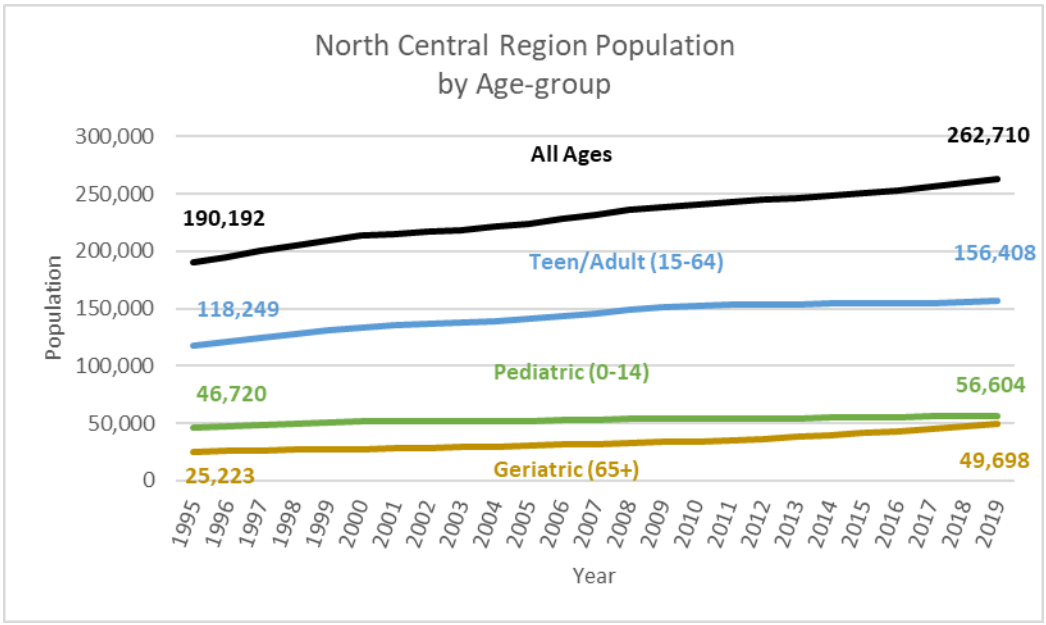

Figure 11 North Central Region Population by Age-group, 1995-2019

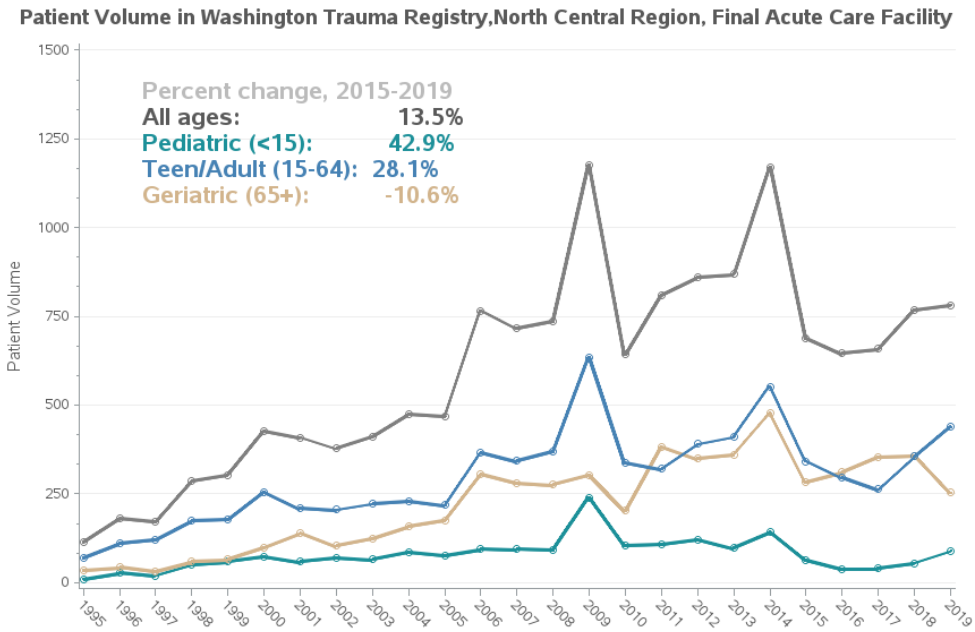

Figure 12 Trauma Volume by Age-group, North Central Region

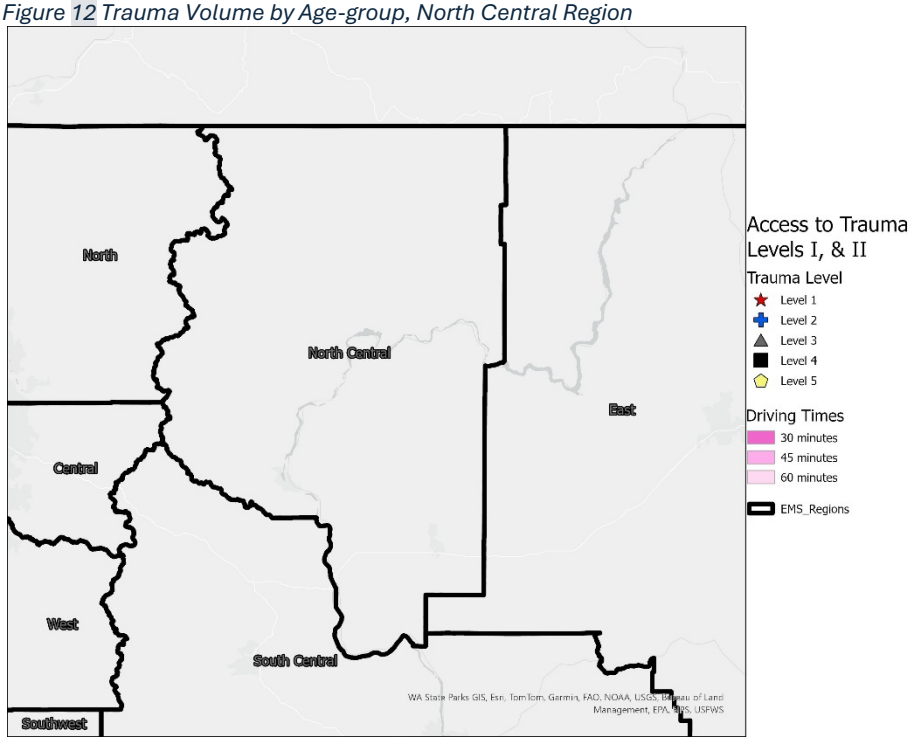

Figure 13 Trauma Levels I &II Driving Times to facilities within North Central Region

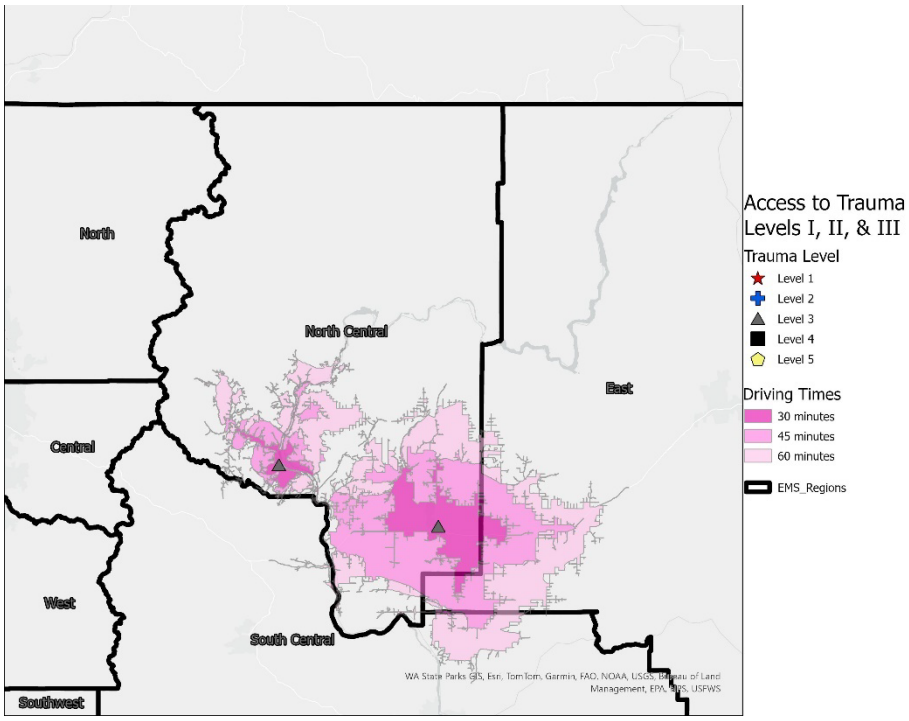

Figure 14 Trauma Levels I, II, & III Driving Times to facilities within North Central Region

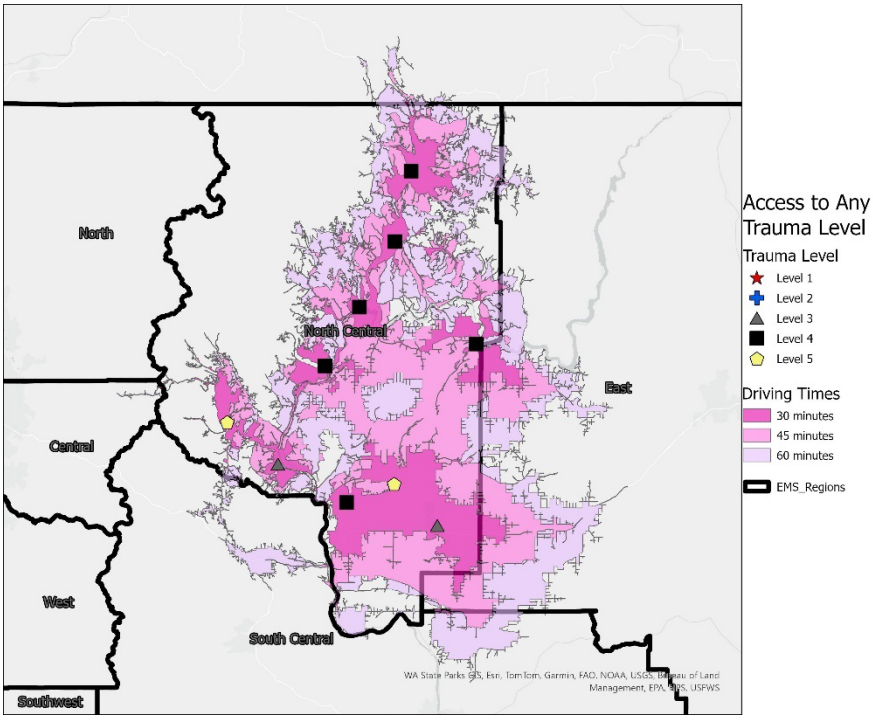

Figure 15 Any Trauma Level Driving Times to facilities within North Central Region

Population within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
North Central	≤30 min%	0%	55%	84%
	≤45 min%	0%	68%	92%
	≤60 min%	3%	76%	98%

Figure 16 Central Region population within driving distances to trauma center

Percent of trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
North Central	≤30 min%	0%	54%	83%
	≤45 min%	1%	70%	91%
	≤60 min%	6%	80%	97%

Figure 17 Central Region trauma incidents within driving distances to trauma centers

Percent of Severe Trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
North Central	≤30 min%	0%	67%	87%
	≤45 min%	0%	79%	90%
	≤60 min%	3%	87%	100%

Figure 18 Central Region severe trauma incidents within driving distances to trauma centers

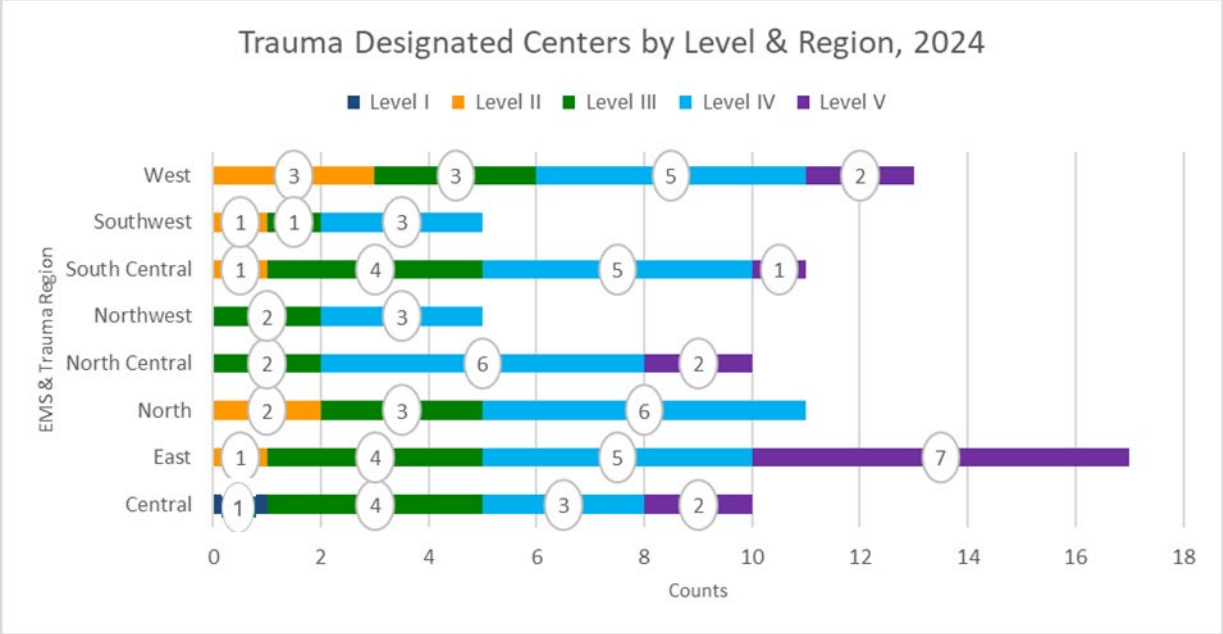

Figure 19 Trauma Designated Centers by Level & Region, 2024

Trauma Patients Initial and Highest Designated Level of Care (%), North Central Region, 2019

		Highest Level of Care				
		Level I	Level II	Level III	Level IV	Level V
Initial Level of Care	Level I	100%	-	-	-	-
	Level II	-	100%	-	-	-
	Level III	14%	1%	85%	-	-
	Level IV	8%	22%	8%	63%	-
	Level V	3%	11%	16%	-	71%

Figure 20 Trauma Patients Initial & Highest Designated Level of Care (%), North Central Region, 2019

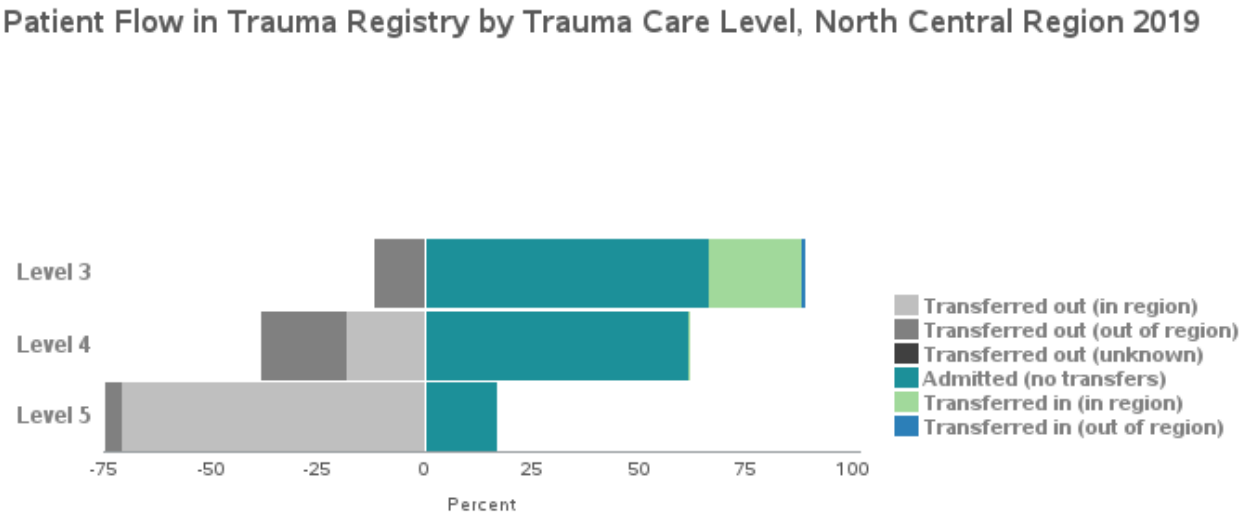

Figure 21 Patient Flow in Trauma Registry by Trauma Level of Care, North Central Region 2019

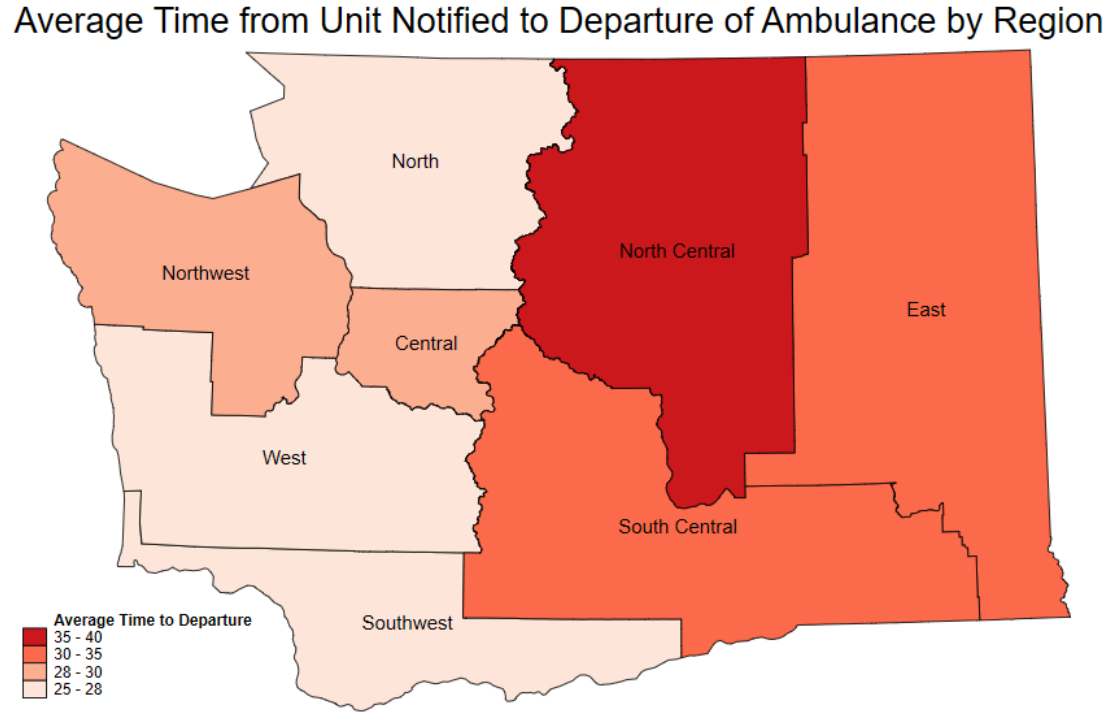

Figure 22 Average Time from EMS Unit Notification to Scene Departure by Region

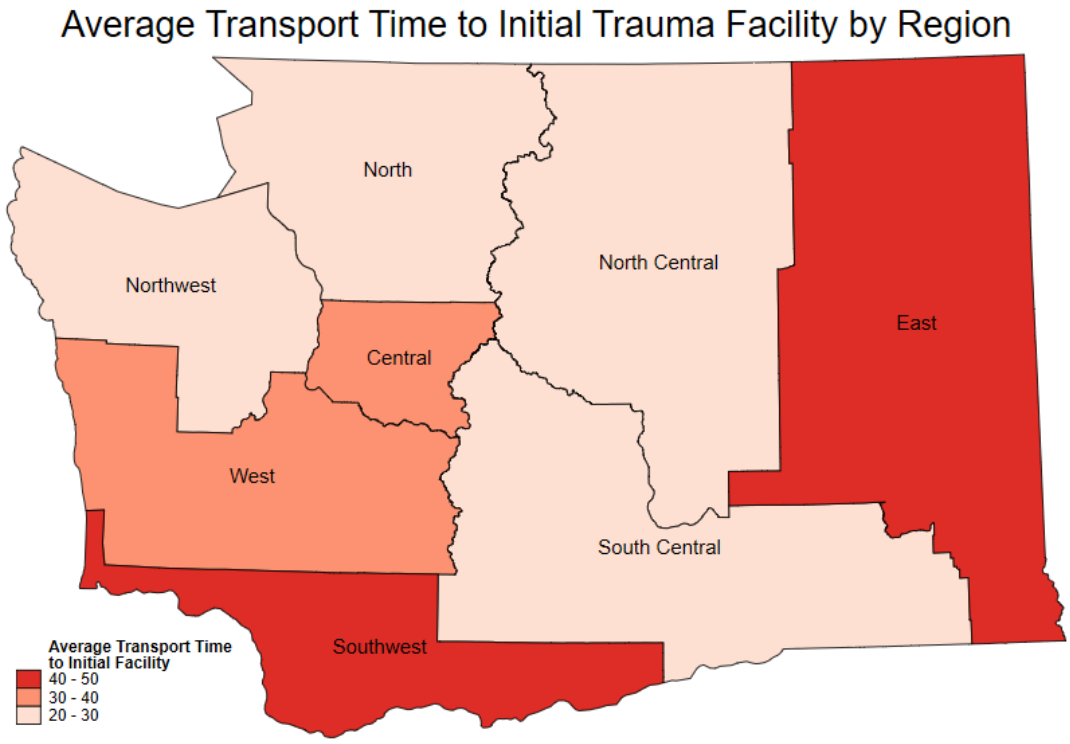

Figure 23 Average Transport Time from Scene Departure to Initial Facility by Region

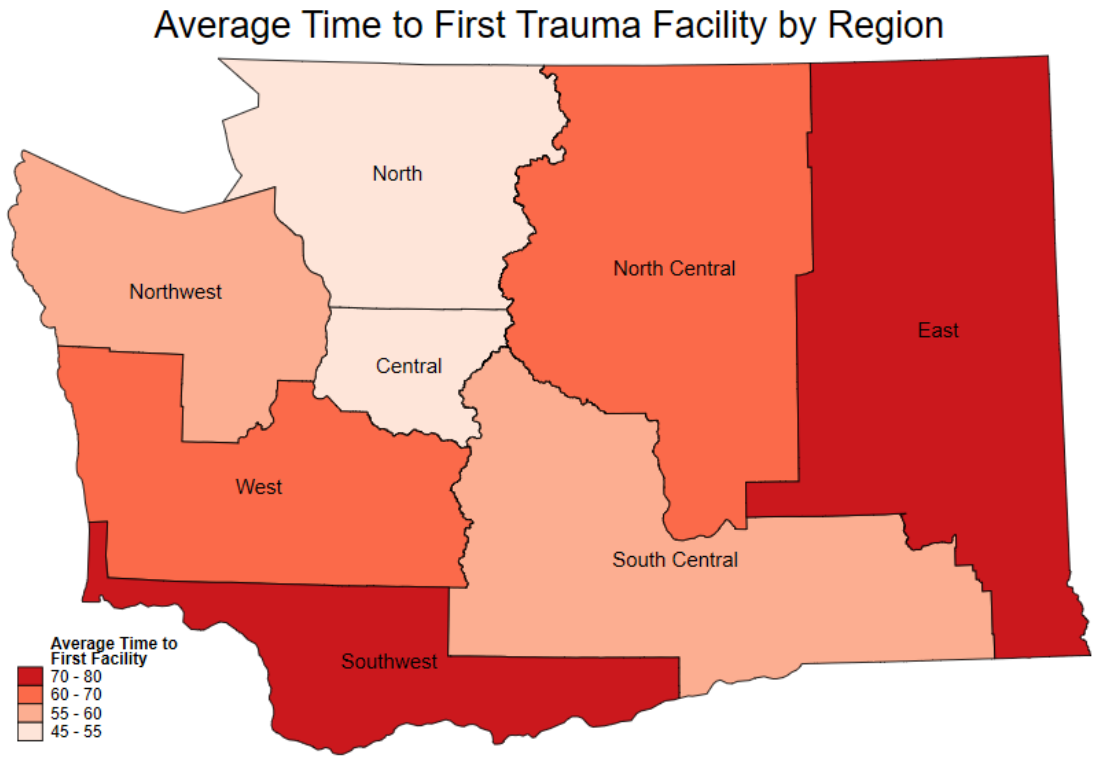

Figure 24 Average Time from EMS Unit Notification to First Trauma Facility by Region

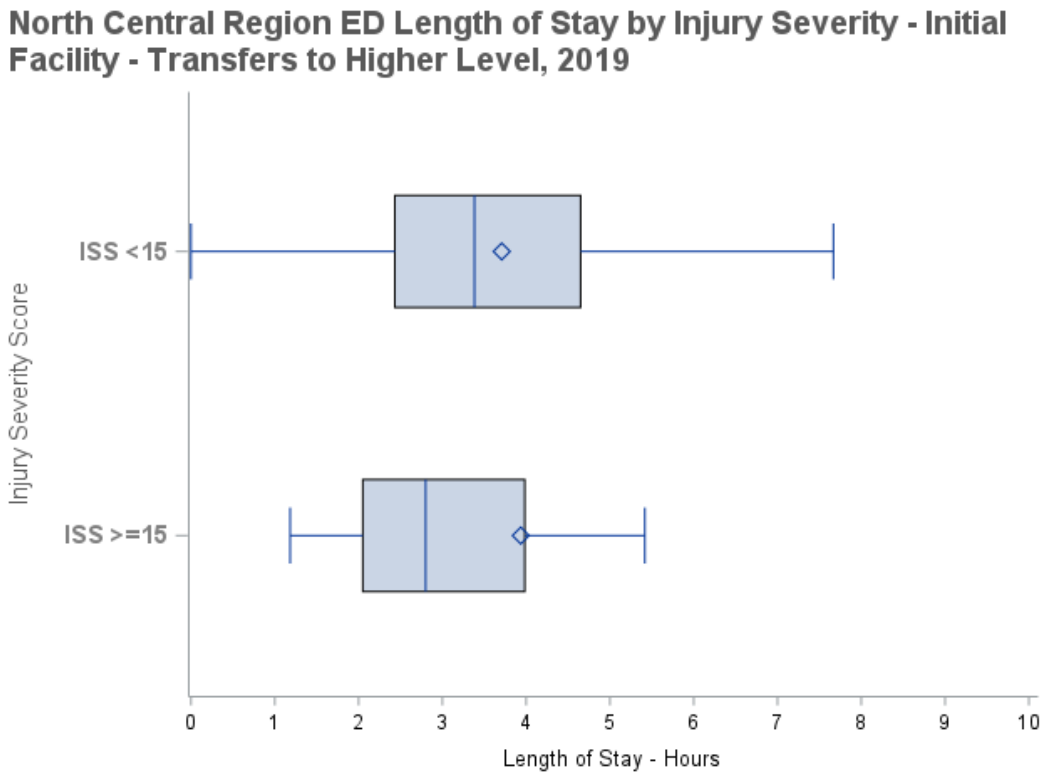

Figure 25 North Central region Emergency Department Length of Stay at Initial Facility, Patients Transferred to Higher Level of Care, by ISS

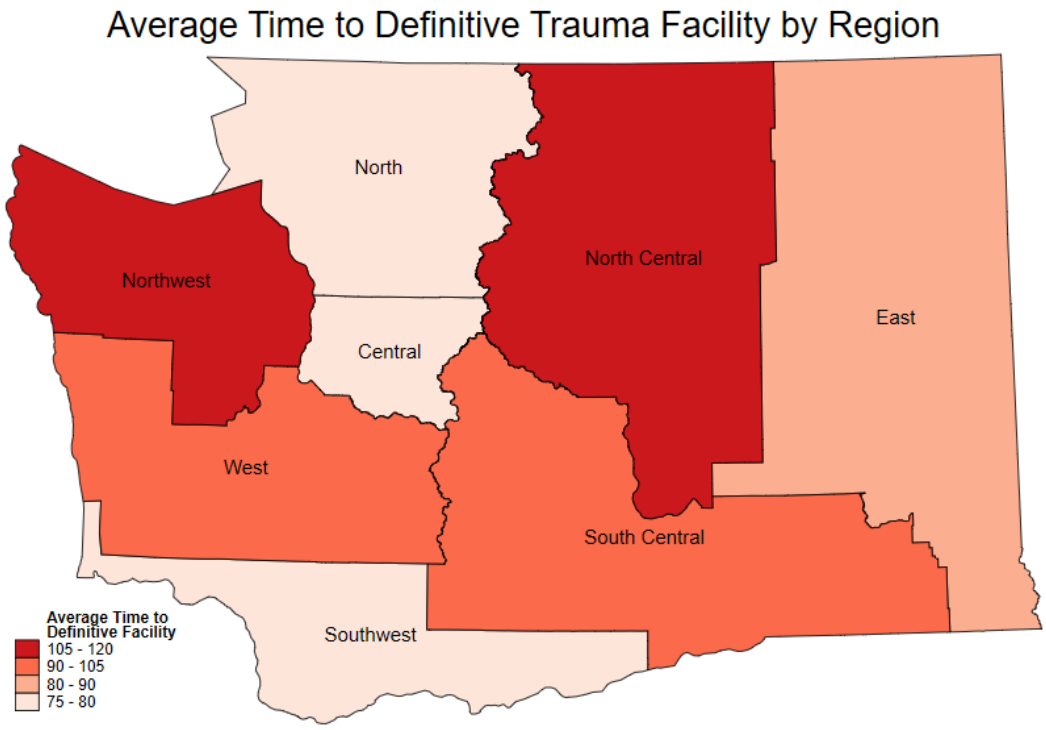

Figure 26 Average Time from EMS Unit Notification to Definitive Trauma Facility by Region

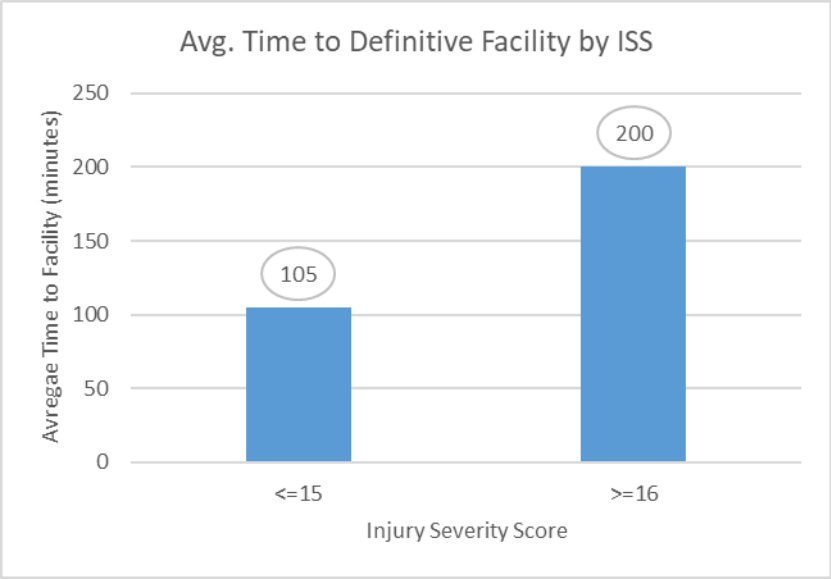

Figure 27 Average Time to Definitive Trauma Facility by Injury Severity Score, North Central Region

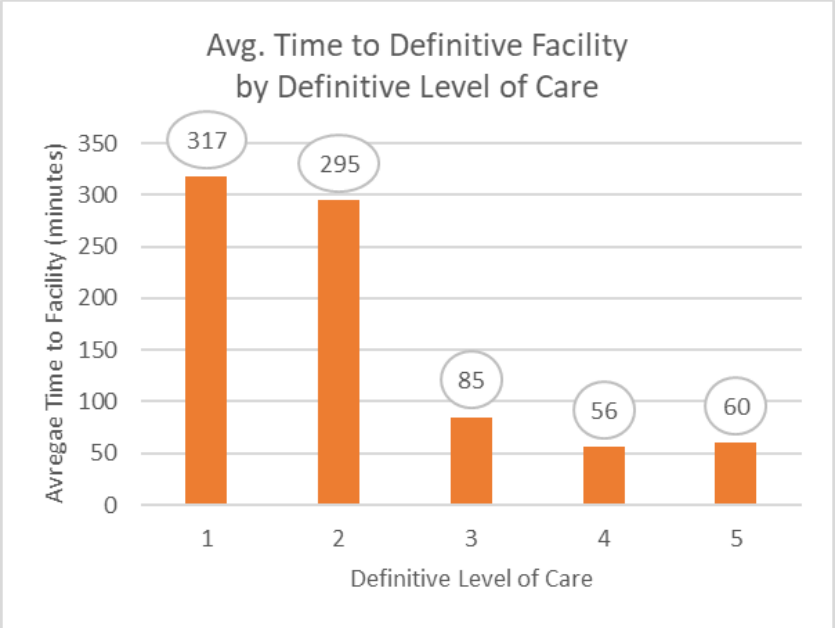

Figure 28 Average Time to Definitive Care by Level of Definitive Facility, North Central Region

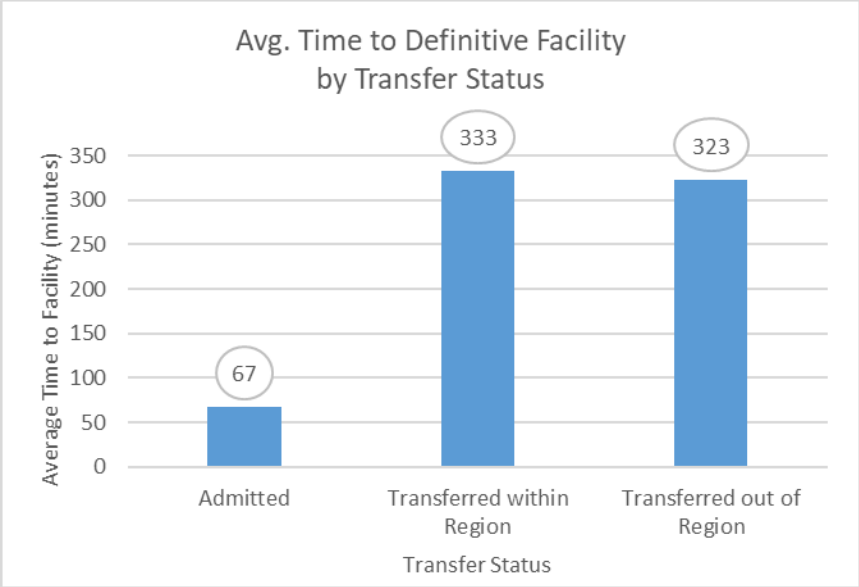

Figure 29 Average Time from EMS Unit Notification to Definitive Facility by Transfer Status, North Central Region, 2019

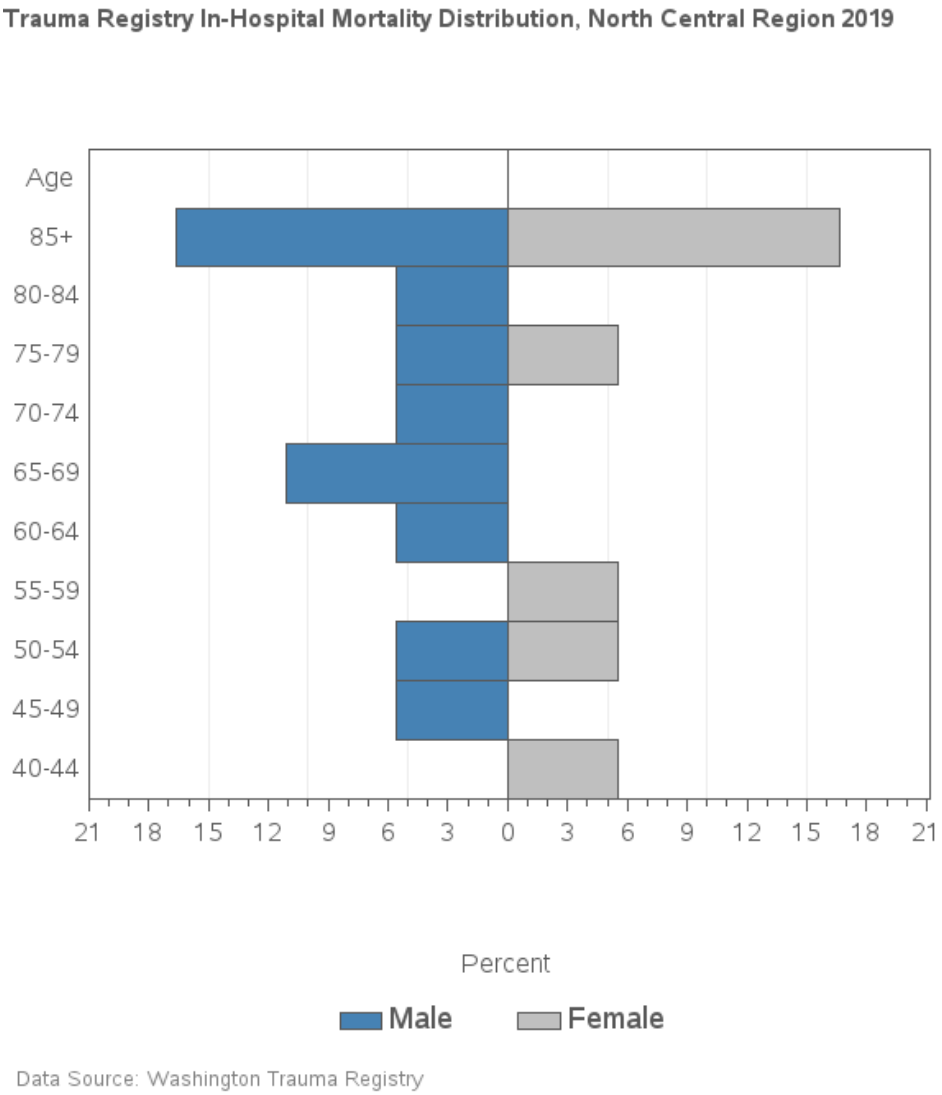

Figure 30 Trauma Registry In-hospital Mortality Distribution, North Central Region 2019

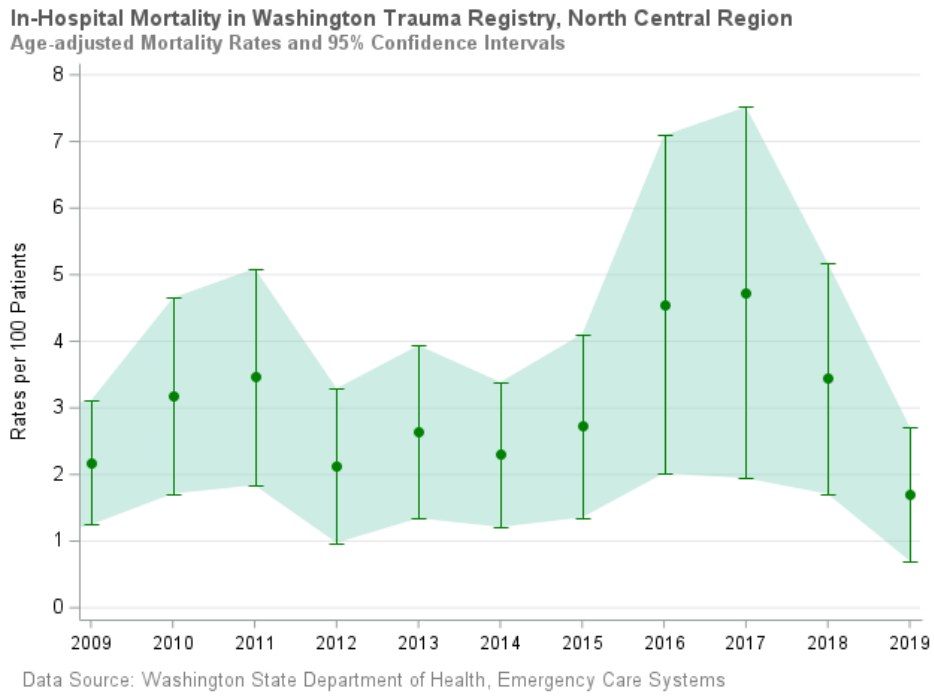

Figure 31 Age-adjusted Mortality Rates in WA Trauma Registry, North Central Region

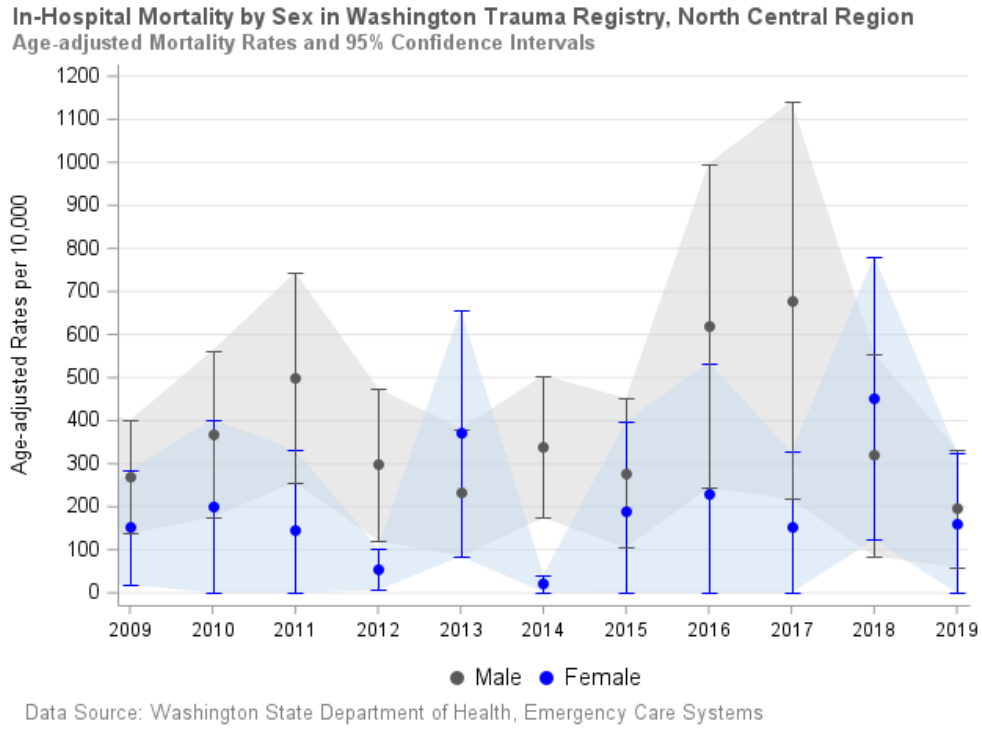

Figure 32 Age-adjusted Mortality Rates by Sex in WA Trauma Registry, North Central Region

Southwest Region data figures and tables

Projected Percent Change in Population by EMS and Trauma Region

Region	Projected Change 2020-2030
Southwest	+21%
State	+10%

Figure 1 Population % Change, 2020-2030, EMS & Trauma Region

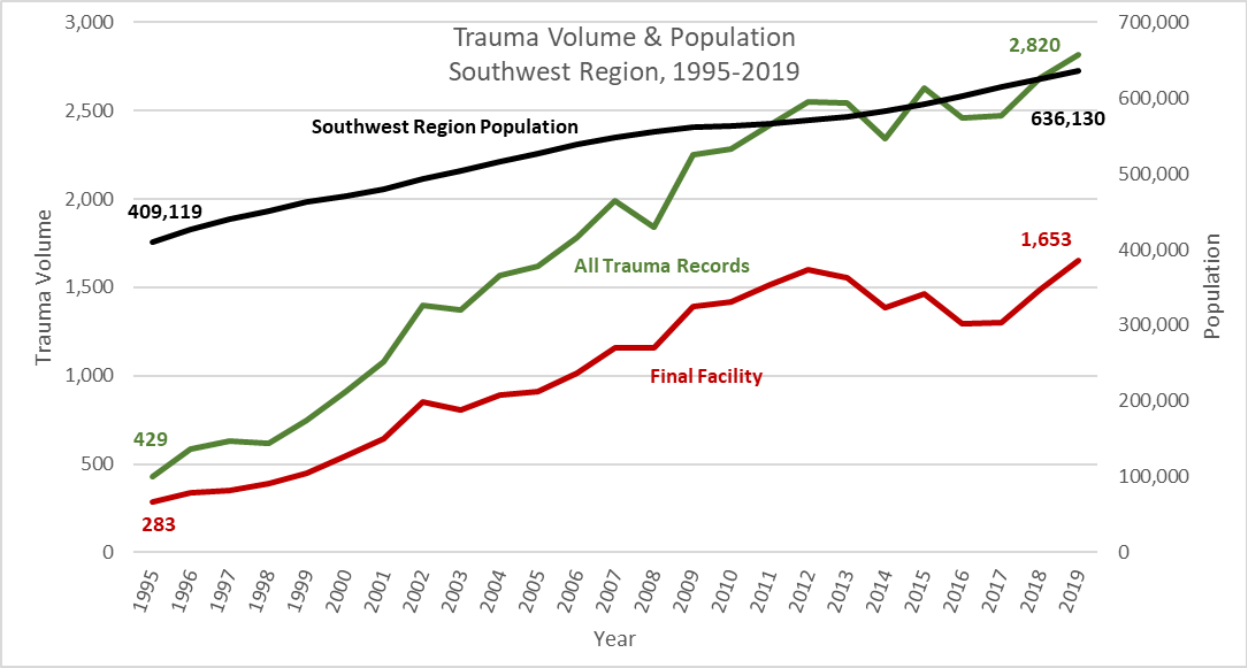

Figure 2 Trauma Volume & Population, Southwest Region 1995-2019

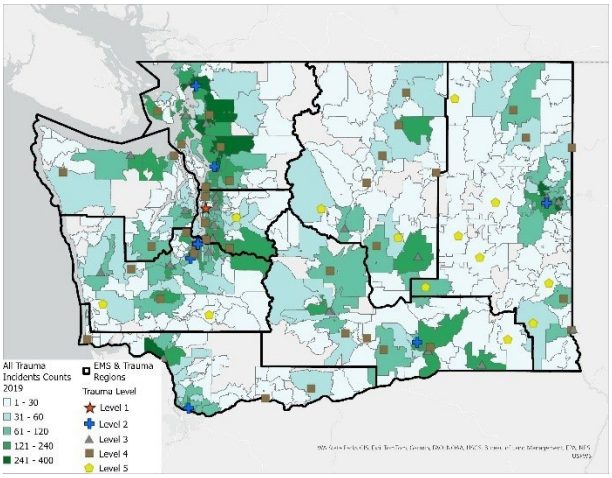

Figure 3 Map of Severe Trauma Distribution by Zip Code, 2019

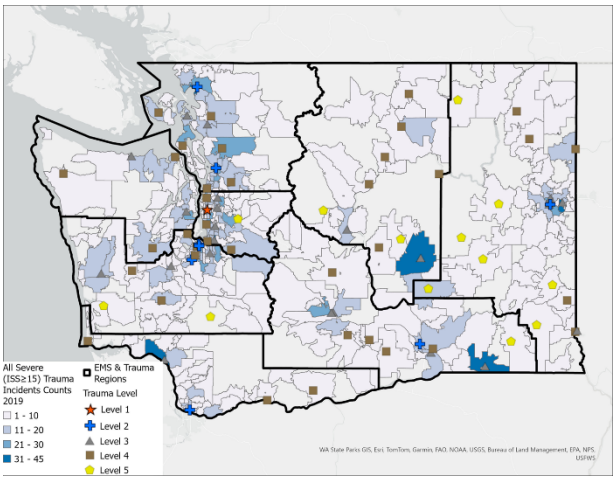

Figure 4 Map of Trauma Distribution by Zip Code, 2019

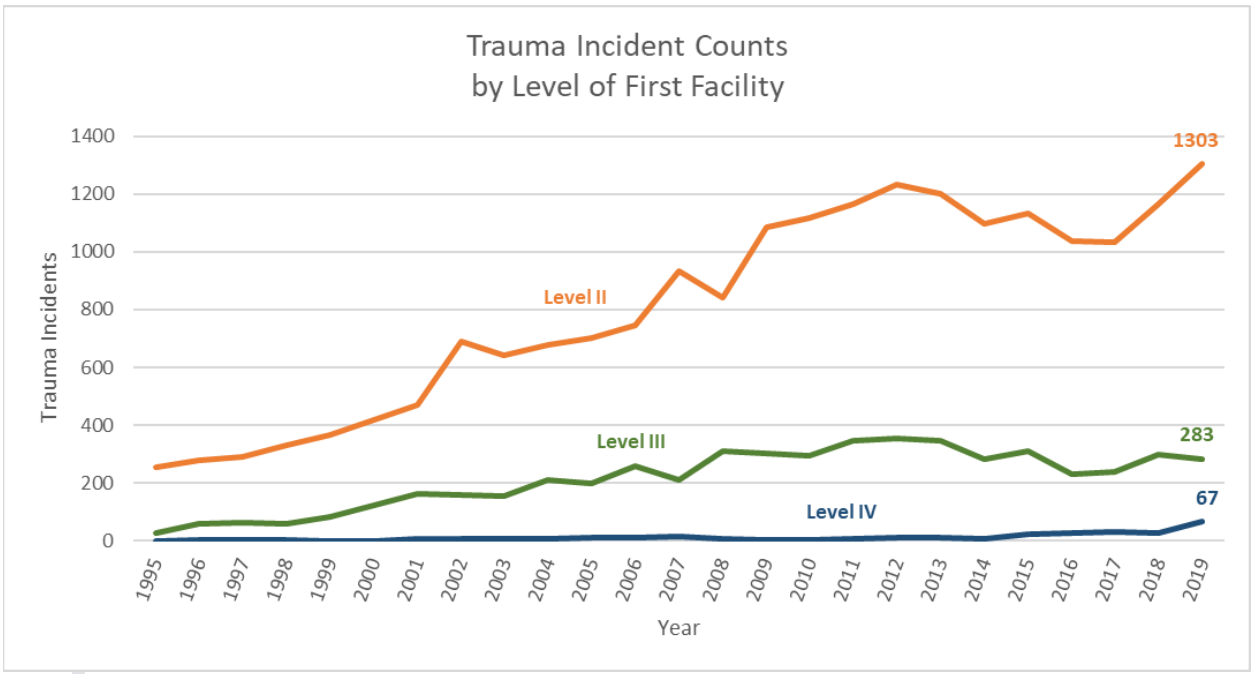

Figure 5 Southwest Region Trauma Incident Counts by Level of First Facility, 1995-2019

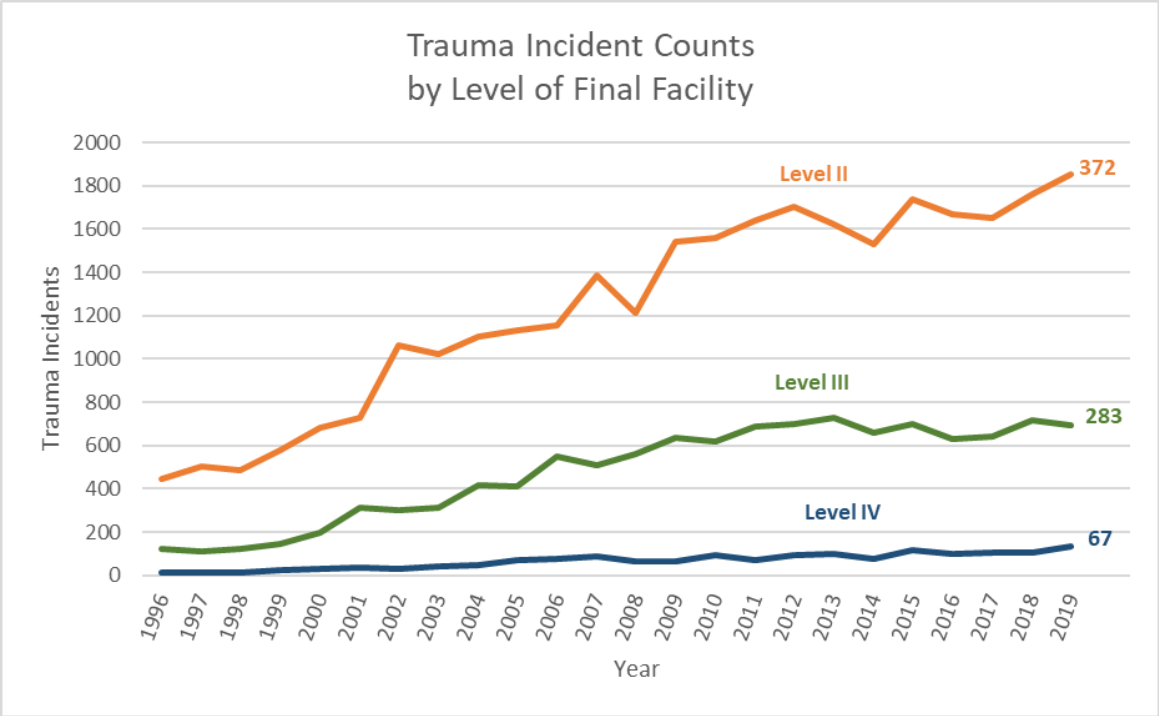

Figure 6 Southwest Region Trauma Incident Counts by Level of Final Facility, 1995-2019

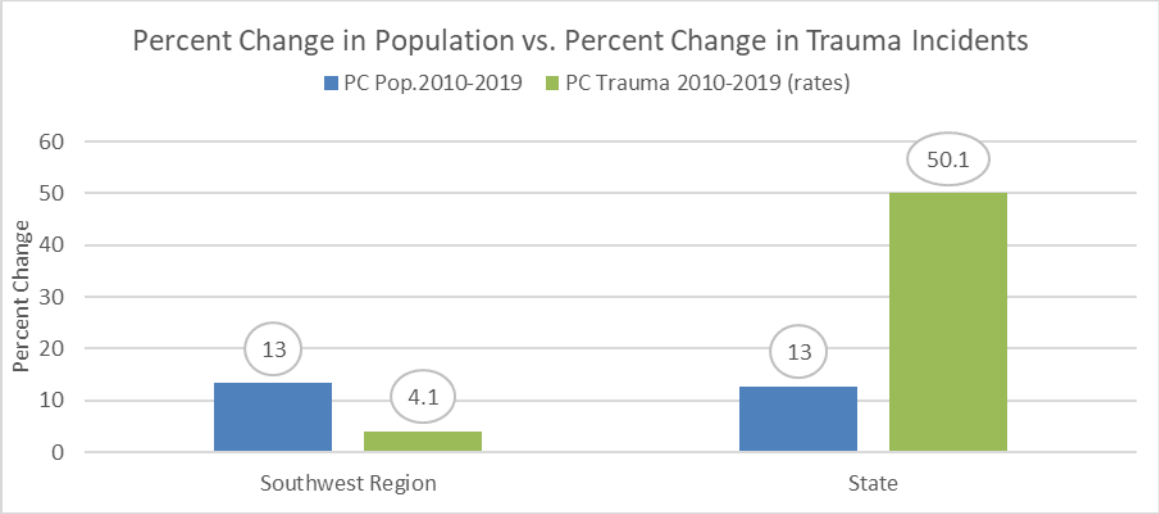

Figure 7 Regional % change in population and trauma incidents, Southwest Region vs. State

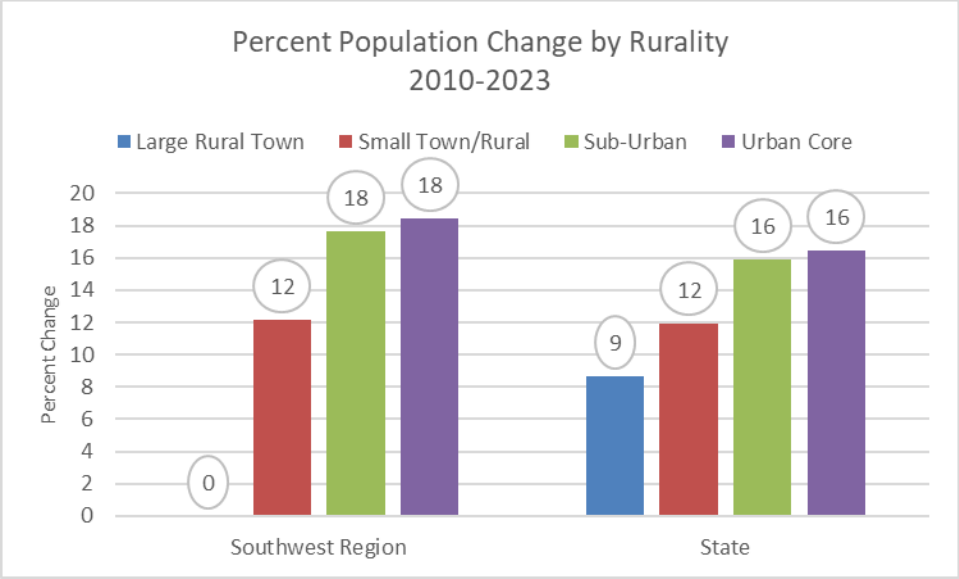

Figure 8 Rurality Population Percent Change, Southwest Region vs. State, 2010-2023

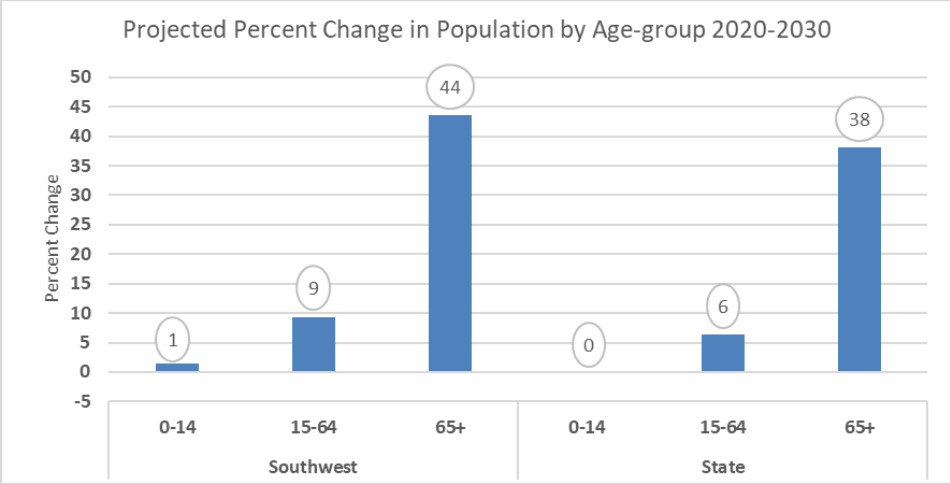

Figure 9 Southwest Region vs. State projected population growth 2020-2030

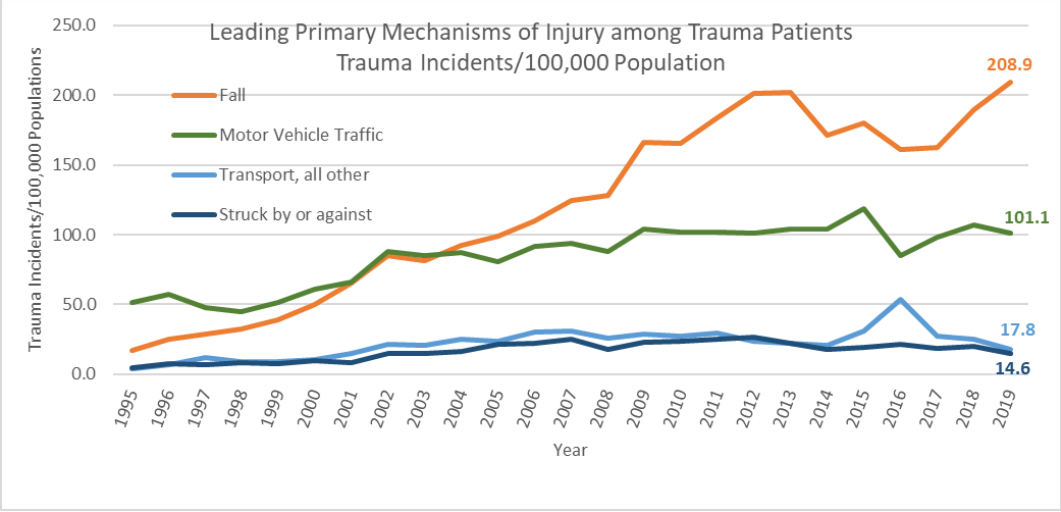

Figure 10 Leading Primary Mechanism of Injury, Southwest Region,1995-2019

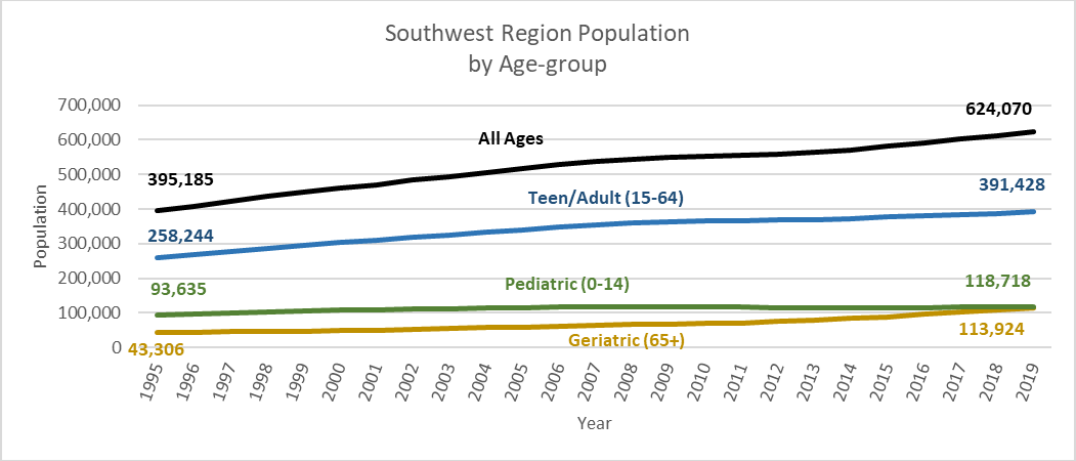

Figure 11 Southwest Region Population by Age-group, 1995-2019

Patient Volume in Washington Trauma Registry,South Central Region,Final Acute Care Facility

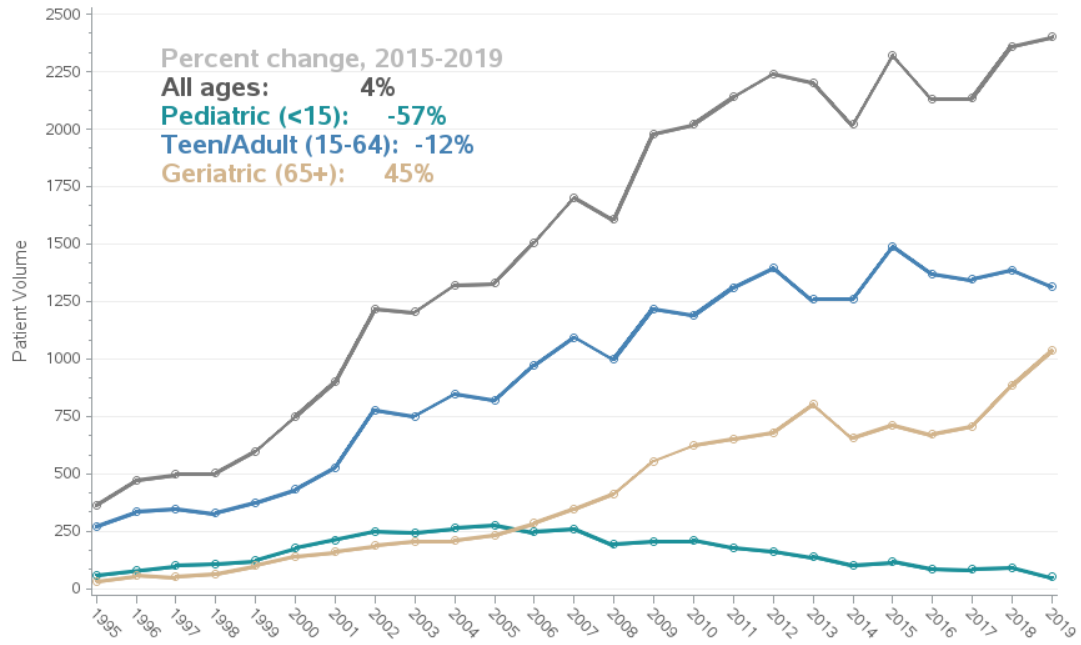

Figure 12 Trauma Volume by Age-group, Southwest Region

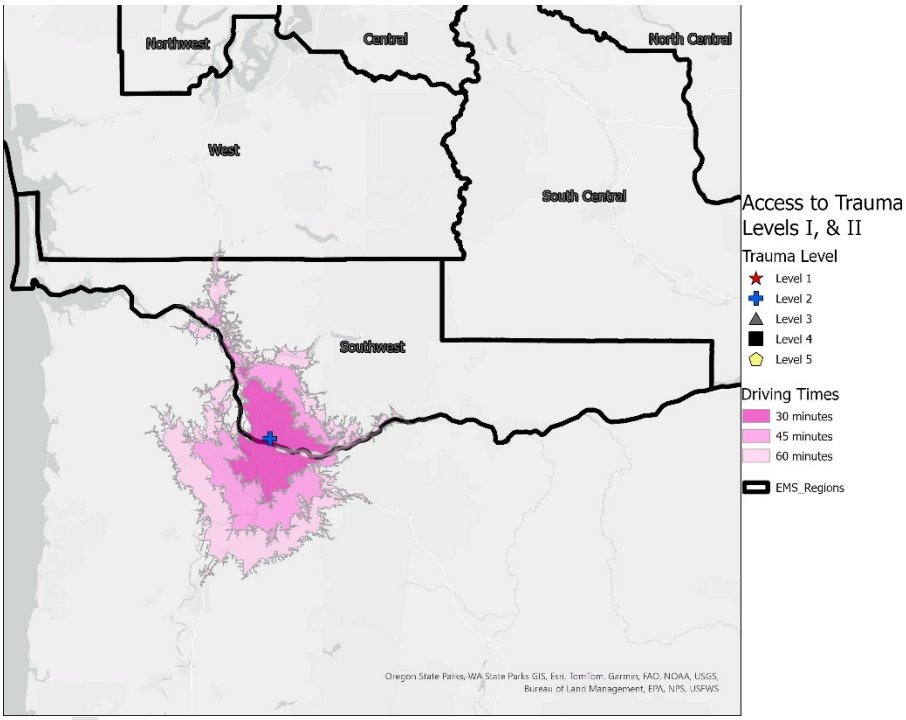

Figure 13 Trauma Levels I &II Driving Times to facilities within Southwest Region

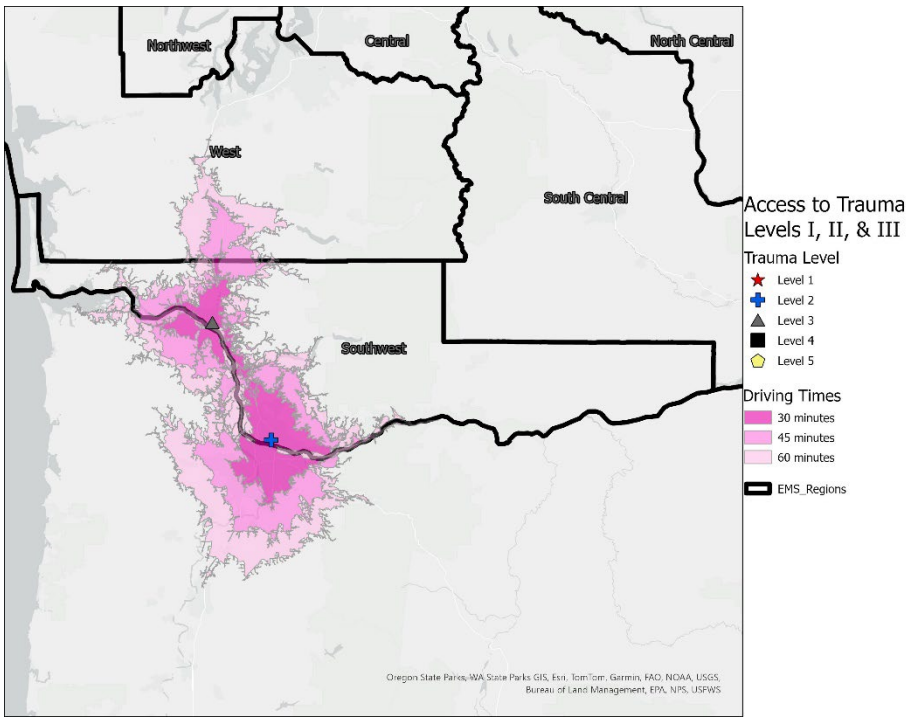

Figure 14 Trauma Levels I, II, & III Driving Times to facilities within Southwest Region

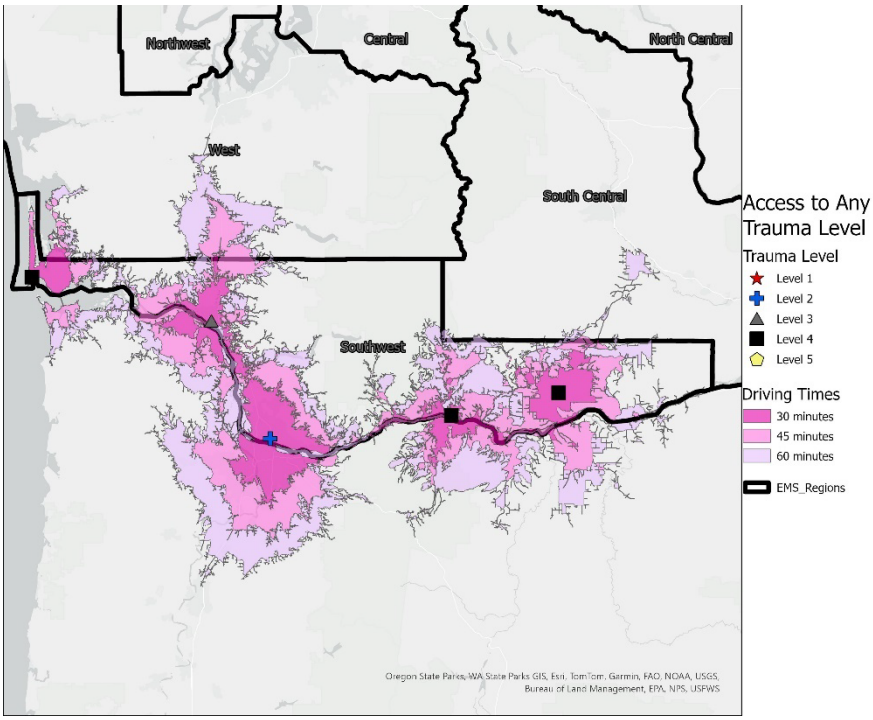

Figure 15 Any Trauma Level Driving Times to facilities within Southwest Region

Population within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
Southwest	≤30 min%	70%	85%	89%
	≤45 min%	81%	91%	97%
	≤60 min%	90%	93%	99%

Figure 16 Southwest Region population within driving distances to trauma center

Percent of trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
Southwest	≤30 min%	74%	86%	91%
	≤45 min%	85%	92%	98%
	≤60 min%	94%	95%	100%

Figure 17 Southwest Region trauma incidents within driving distances to trauma centers

Percent of Severe Trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
Southwest	≤30 min%	67%	82%	88%
	≤45 min%	84%	91%	98%
	≤60 min%	93%	94%	100%

Figure 18 Southwest Region severe trauma incidents within driving distances to trauma centers

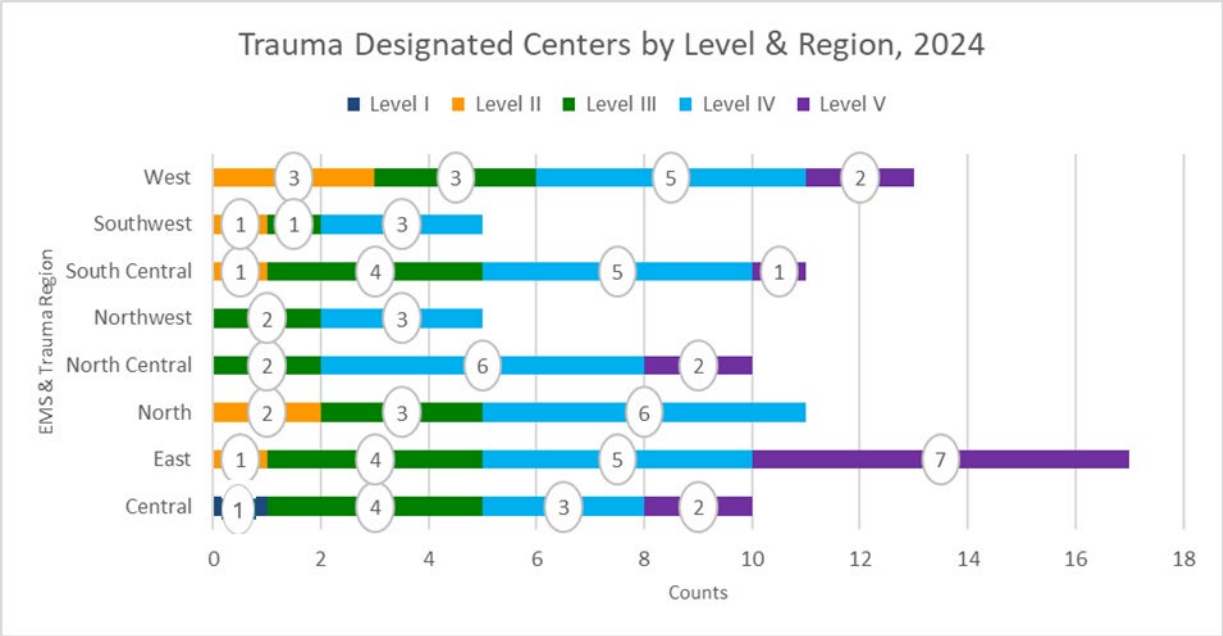

Figure 19 Trauma Designated Centers by Level & Region, 2024

Trauma Patients Initial and Highest Designated Level of Care (%), Southwest Region, 2019

		Highest Level of Care				
		Level I	**Level II**	**Level III**	**Level IV**	**Level V**
Initial Level of Care	**Level I**	100%	-	-	-	-
	Level II	0.1%	99.9%	-	-	-
	Level III	0.3%	28.1%	71.7%	-	-
	Level IV	-	7.6%	2.5%	89.9%	-
	Level V	87.5%	-	-	-	12.5%

Figure 20 Trauma Patients Initial & Highest Designated Level of Care (%), Southwest Region, 2019

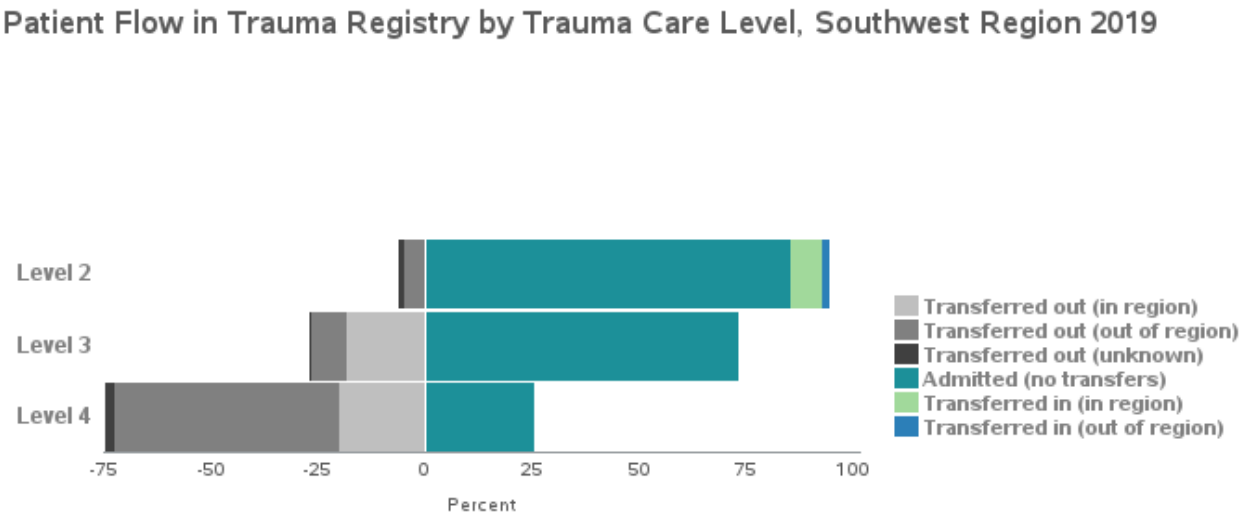

Figure 21 Patient Flow in Trauma Registry by Trauma Level of Care, Southwest Region 2019

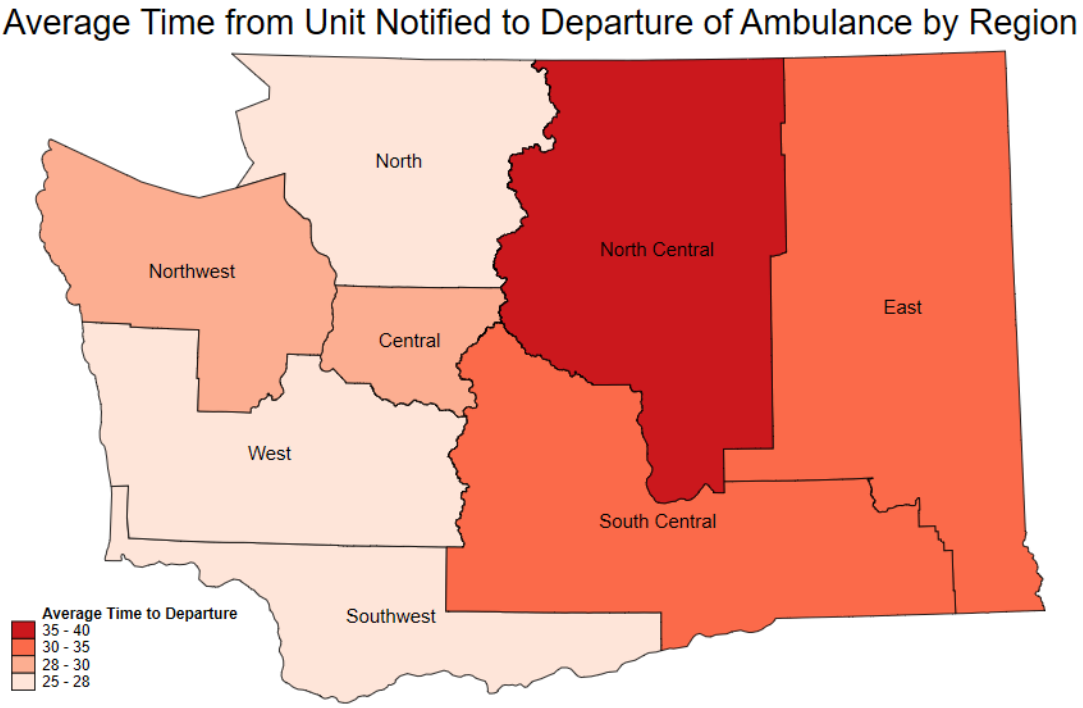

Figure 22 Average Time from EMS Unit Notification to Scene Departure by Region

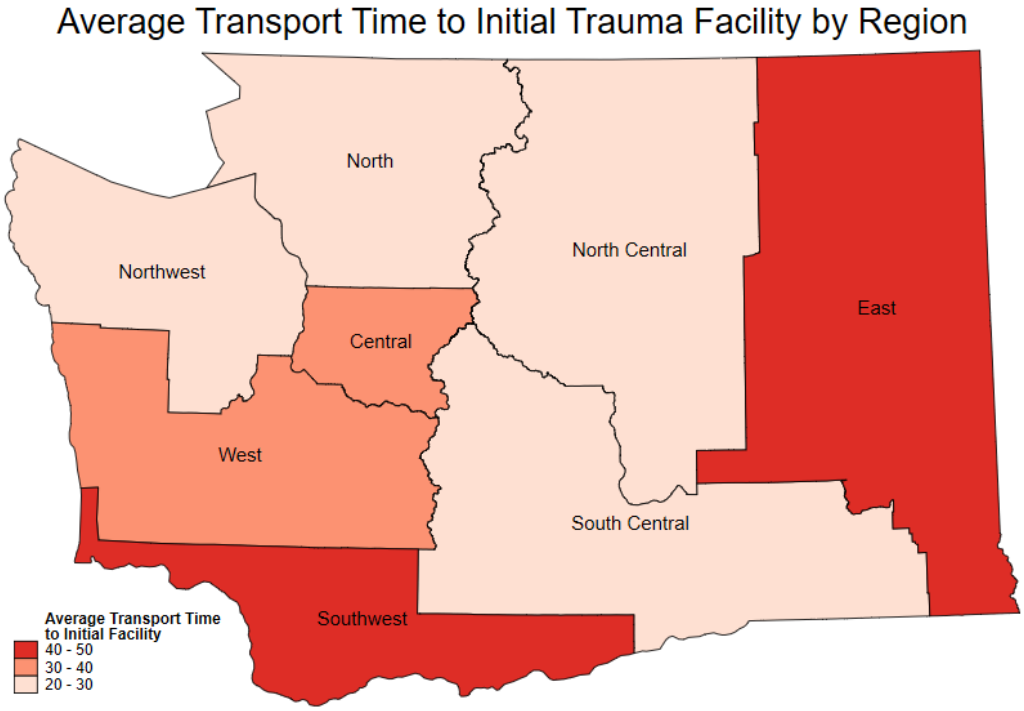

Figure 23 Average Transport Time from Scene Departure to Initial Facility by Region

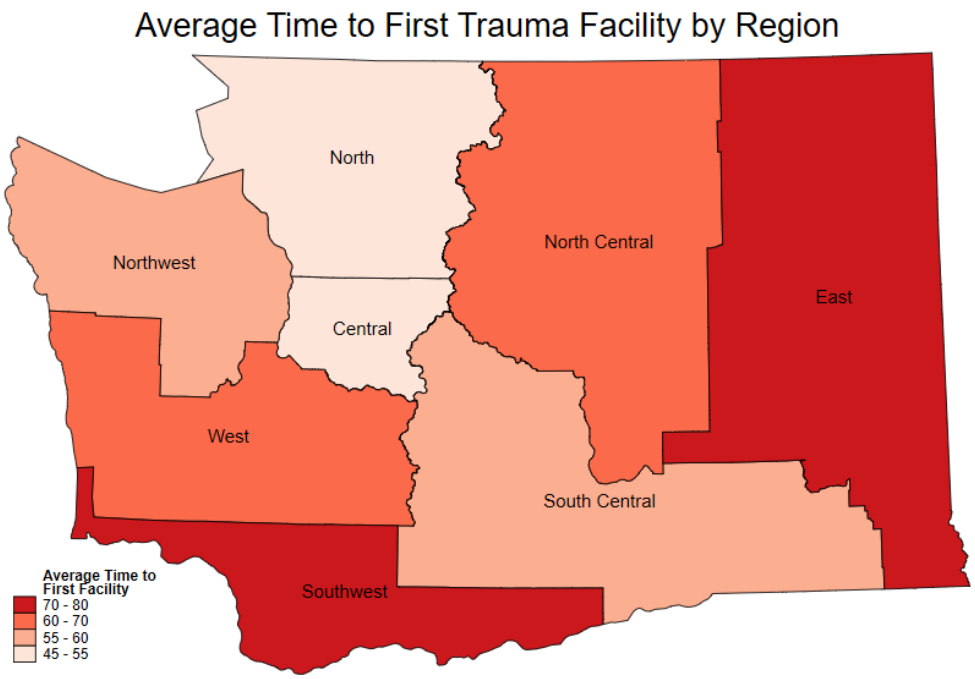

Figure 24 Average Time from EMS Unit Notification to First Trauma Facility by Region

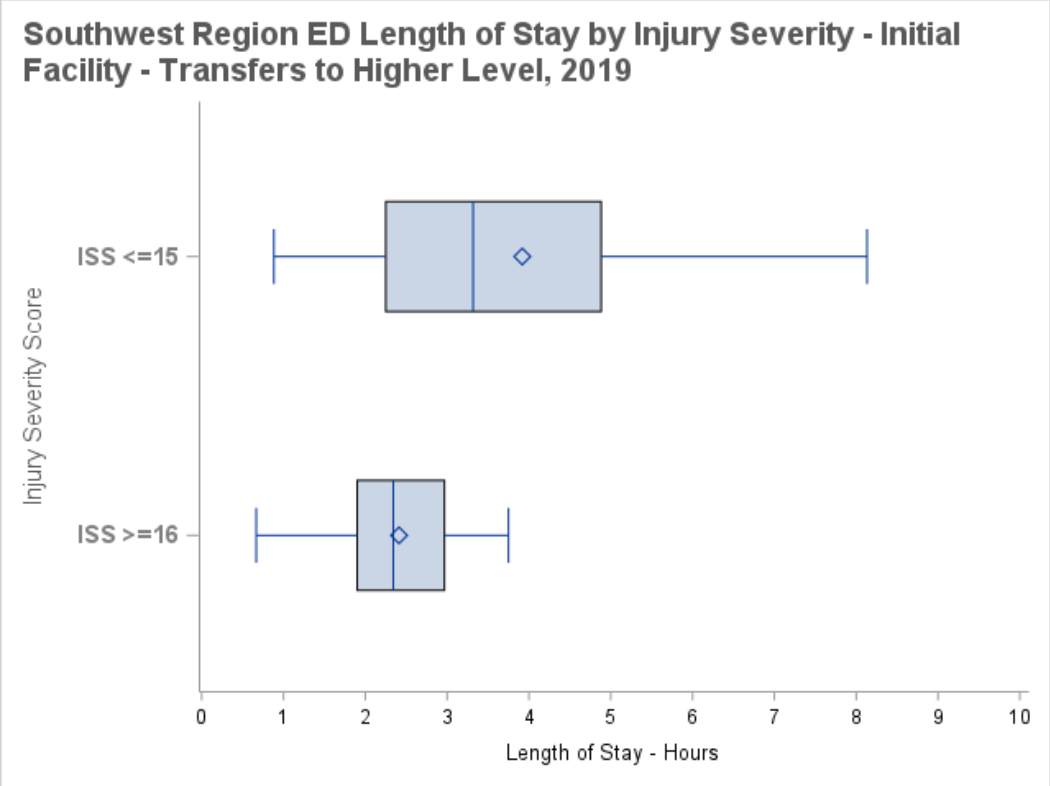

Figure 25 Southwest region Emergency Department Length of Stay at Initial Facility, Patients Transferred to Higher Level of Care, by ISS

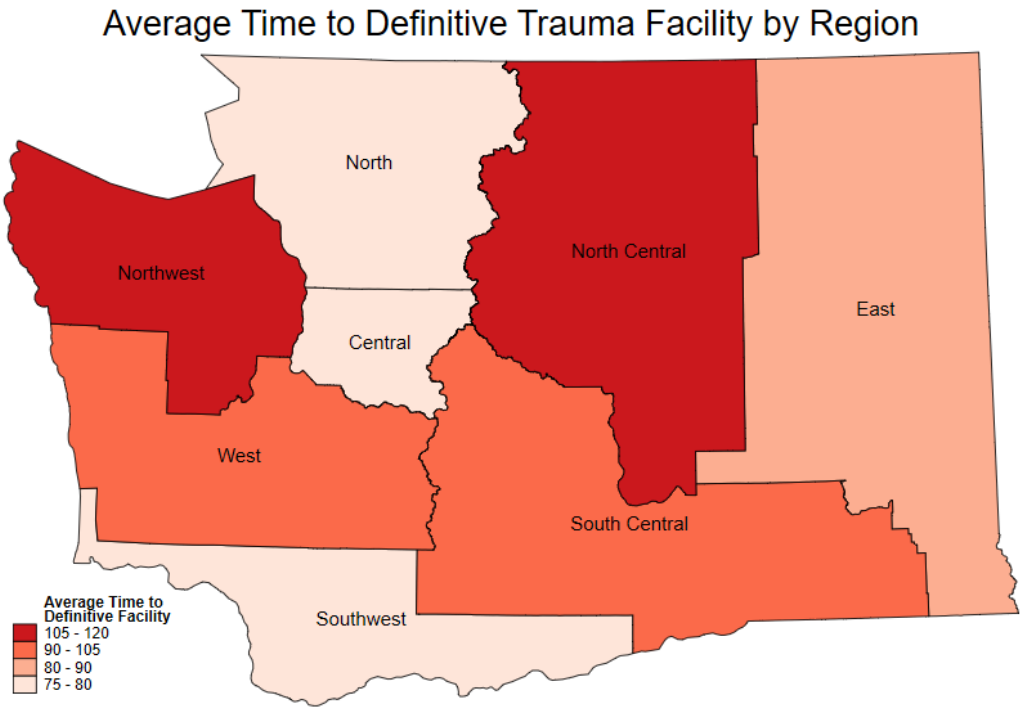

Figure 26 Average Time from EMS Unit Notification to Definitive Trauma Facility by Region

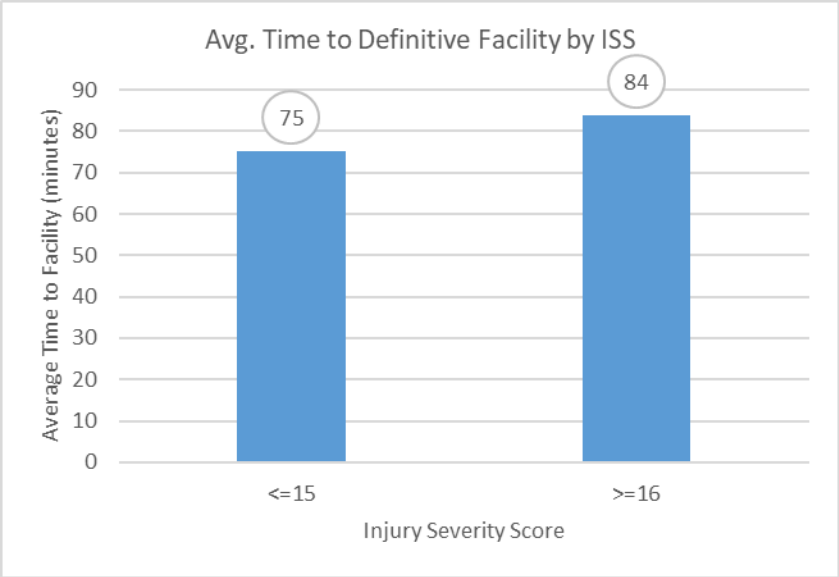

Figure 27 Average Time to Definitive Trauma Facility by Injury Severity Score, Southwest Region

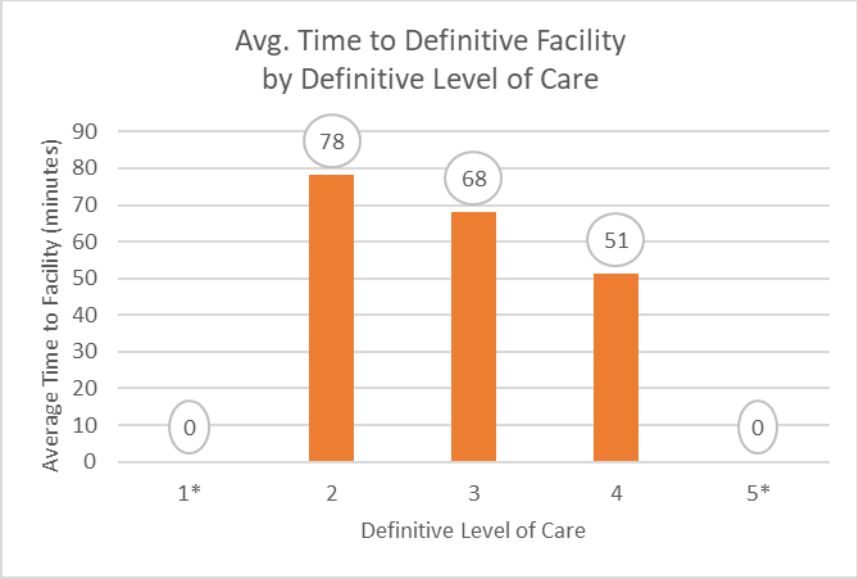

Figure 28 Average Time to Definitive Care by Level of Definitive Facility, Southwest Region
**No linked records with documented time to definitive care were found for levels I & V in 2019.*

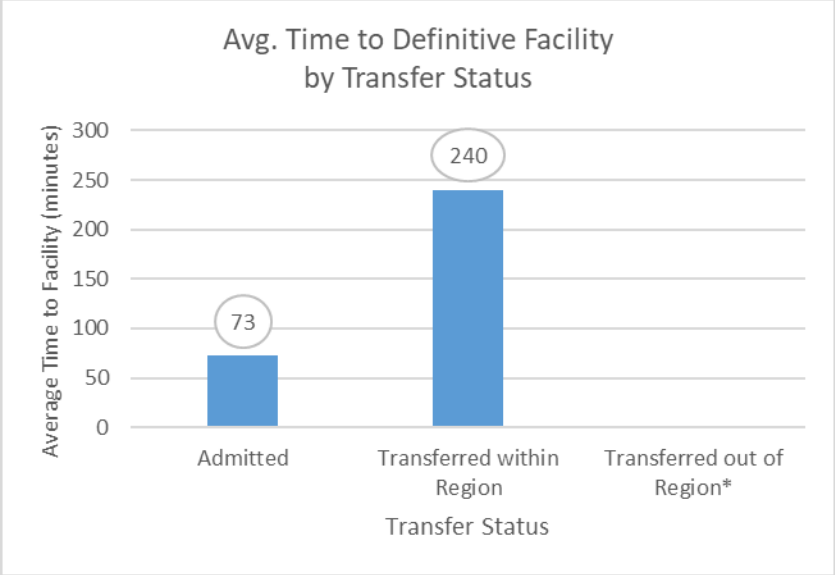

Figure 29 Average Time to Definitive Facility by Transfer Status, Southwest Region, 2019
**Average time to definitive facility for out of region transfers was suppressed as it is based on too few records.*

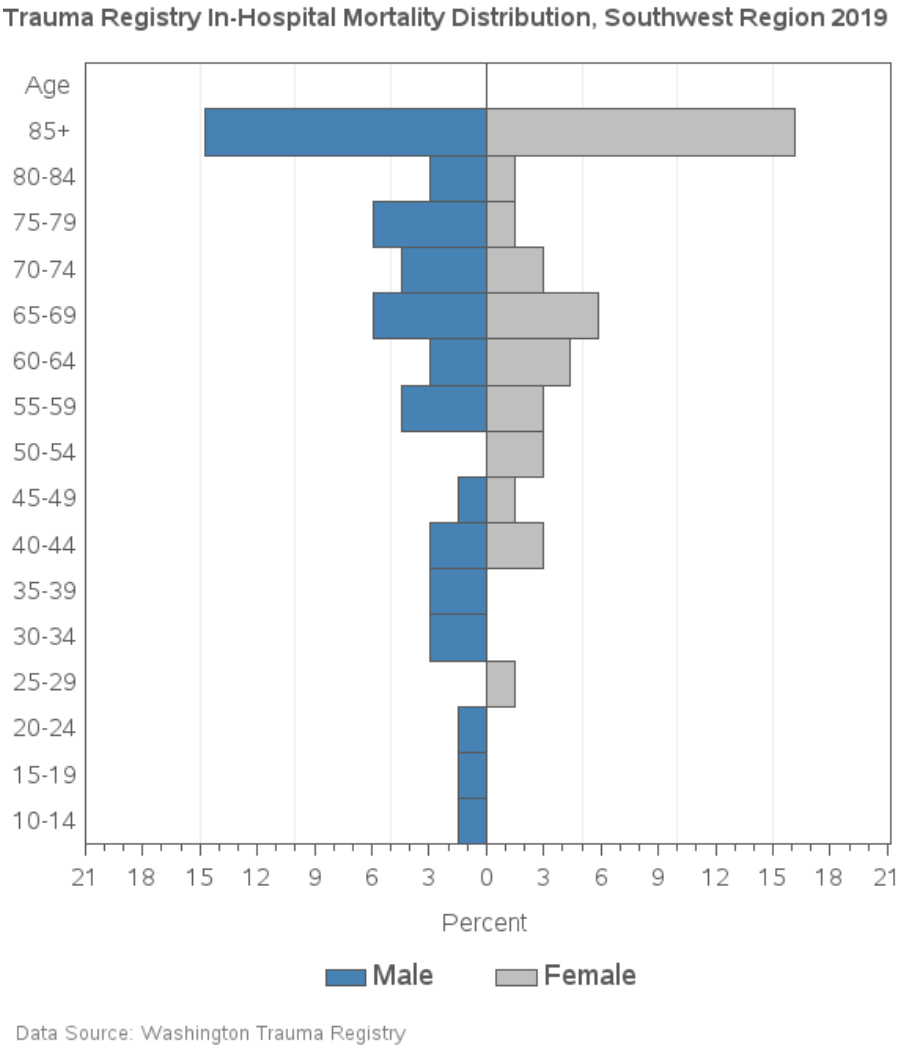

Figure 30 Trauma Registry In-hospital Mortality Distribution, Southwest Region 2019

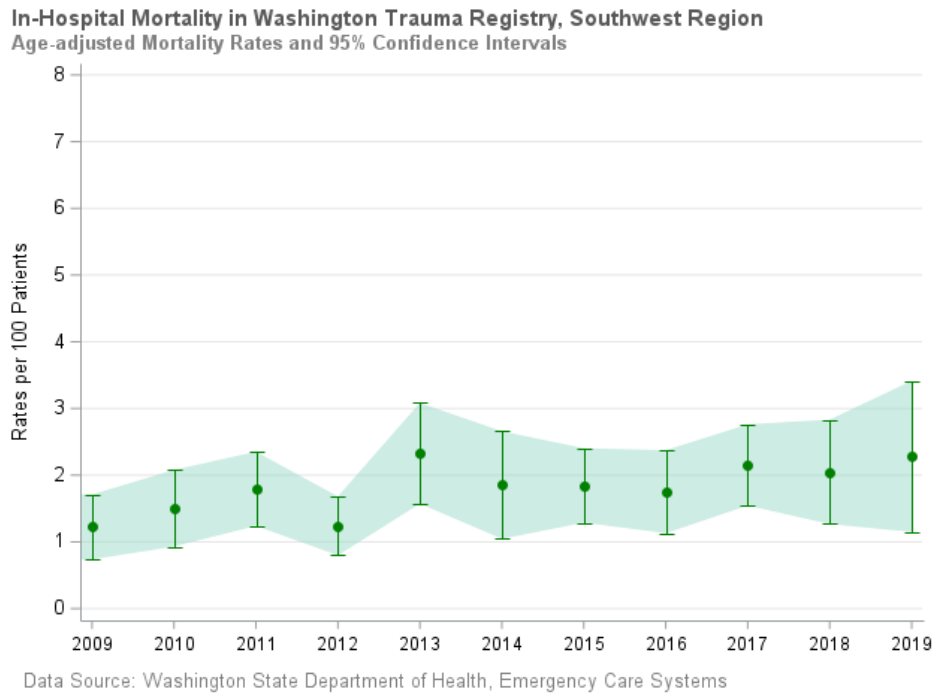

Figure 31 Age-adjusted Mortality Rates in WA Trauma Registry, Southwest Region

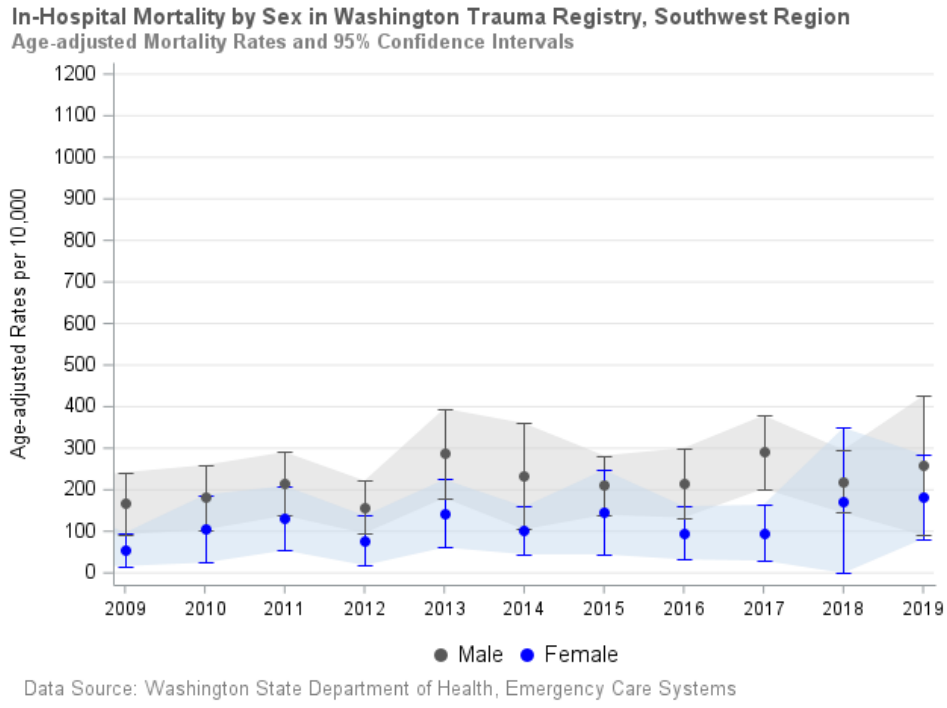

Figure 32 Age-adjusted Mortality Rates by Sex in WA Trauma Registry, Southwest Region

South Central Region data figures and tables

Projected Percent Change in Population by EMS and Trauma Region

Region	Projected Change 2020-2030
South Central	+15%
State	+10%

Figure 1 Population % Change, 2020-2030, EMS & Trauma Region

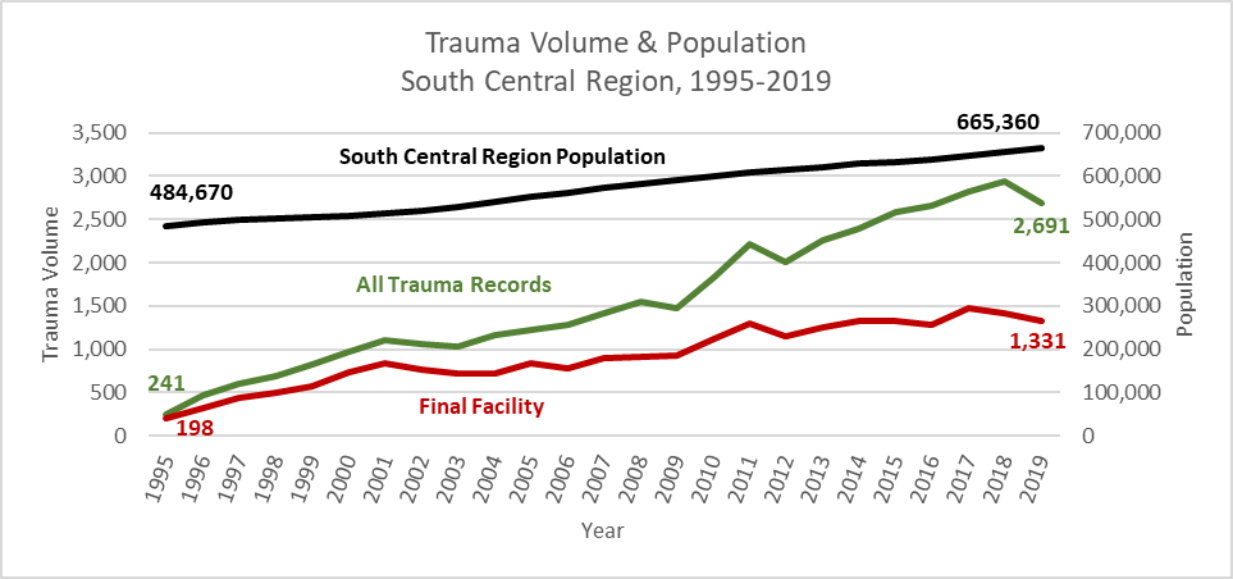

Figure 2 Trauma Volume & Population, South Central Region 1995-2019

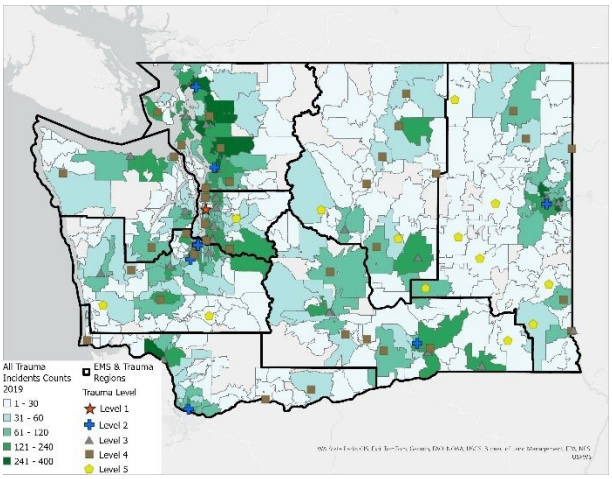

Figure 3 Map of Severe Trauma Distribution by Zip Code, 2019

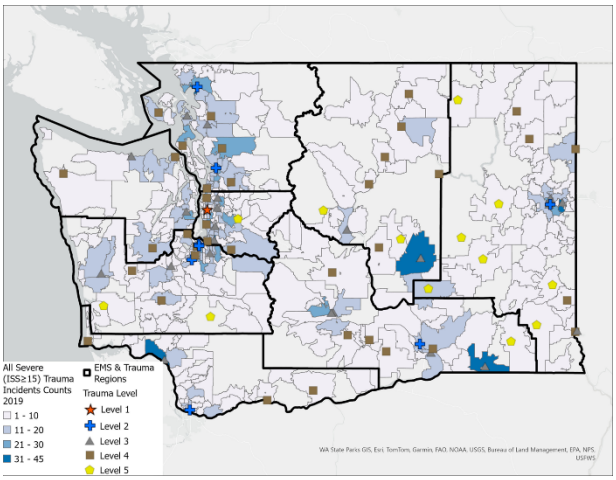

Figure 4 Map of Trauma Distribution by Zip Code, 2019

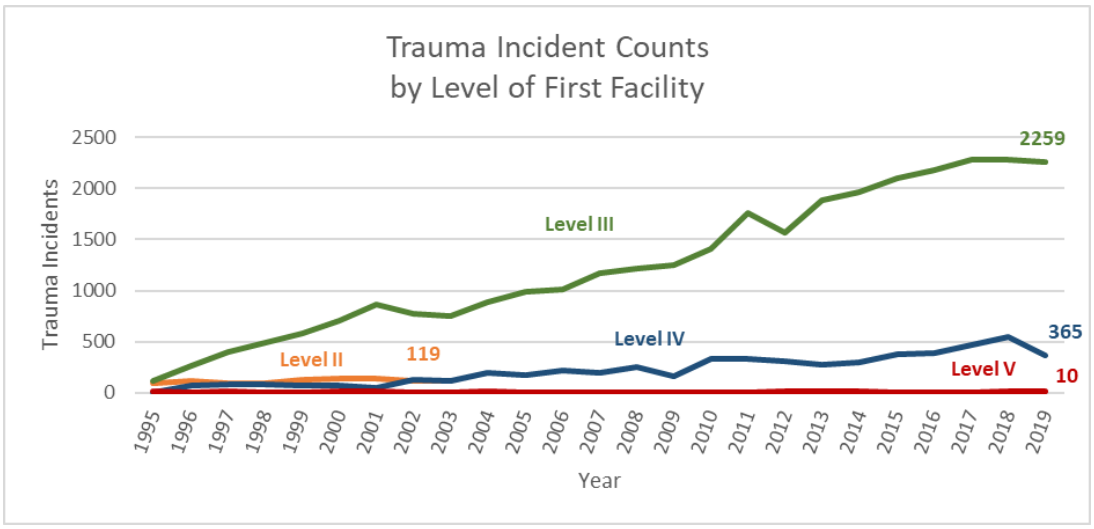

Figure 5 South Central Region Trauma Incident Counts by Level of First Facility, 1995-2019

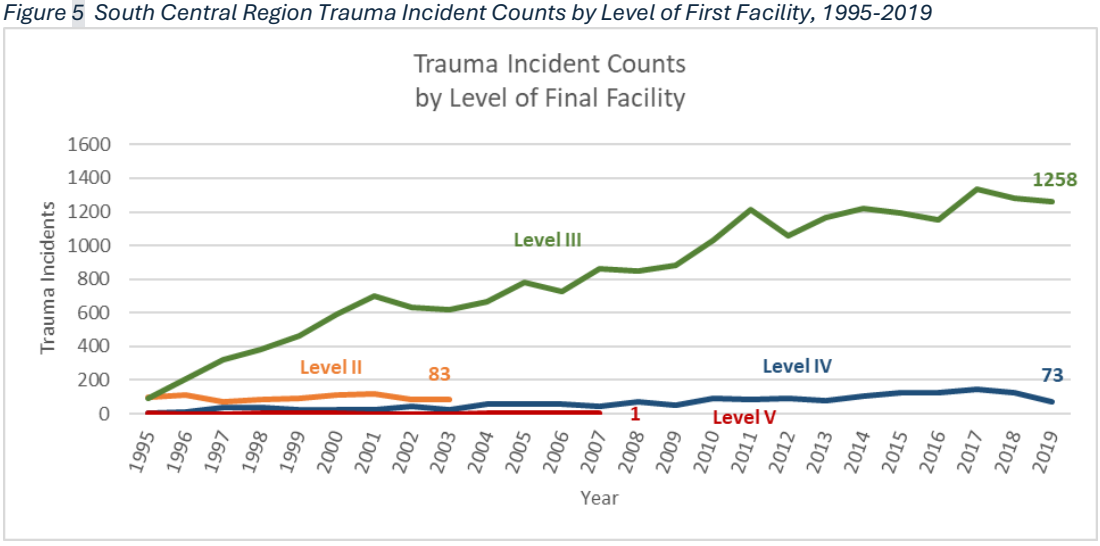

Figure 6 South Central Region Trauma Incident Counts by Level of Final Facility, 1995-2019

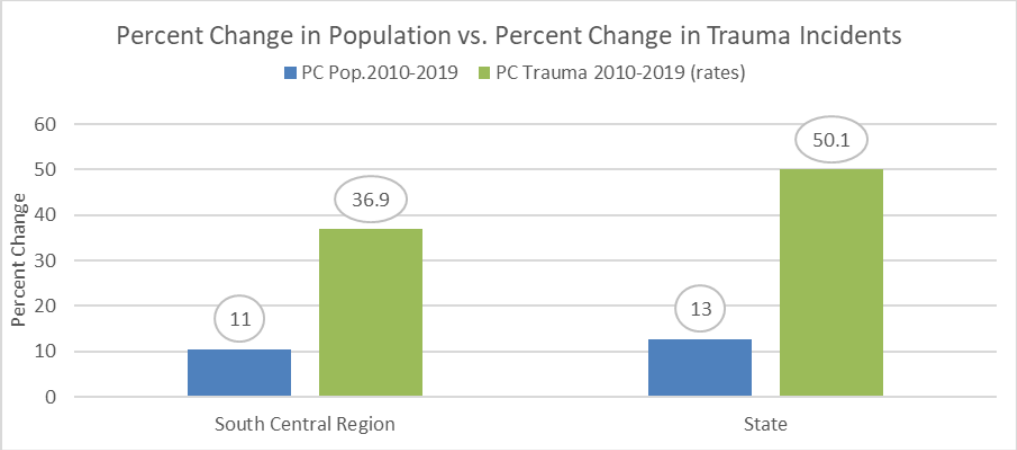

Figure 7 Regional % change in population and trauma incidents, South Central Region vs. State

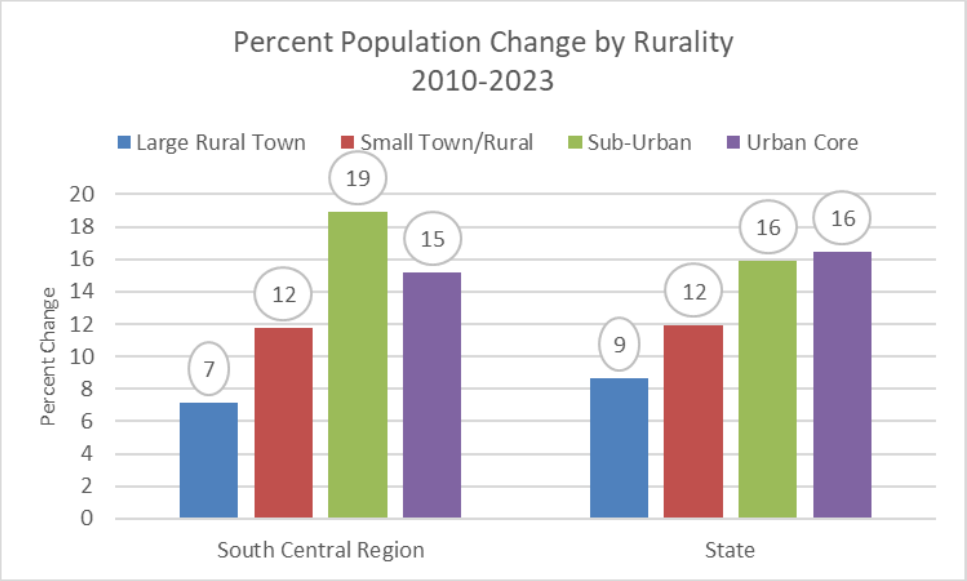

Figure 8 Rurality Population Percent Change, South Central Region vs. State, 2010-2023

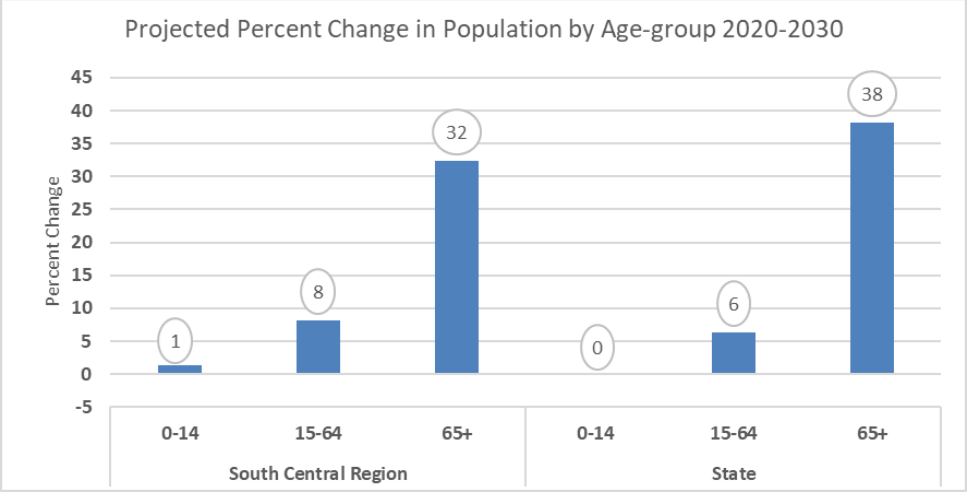

Figure 9 South Central Region vs. State projected population growth 2020-2030

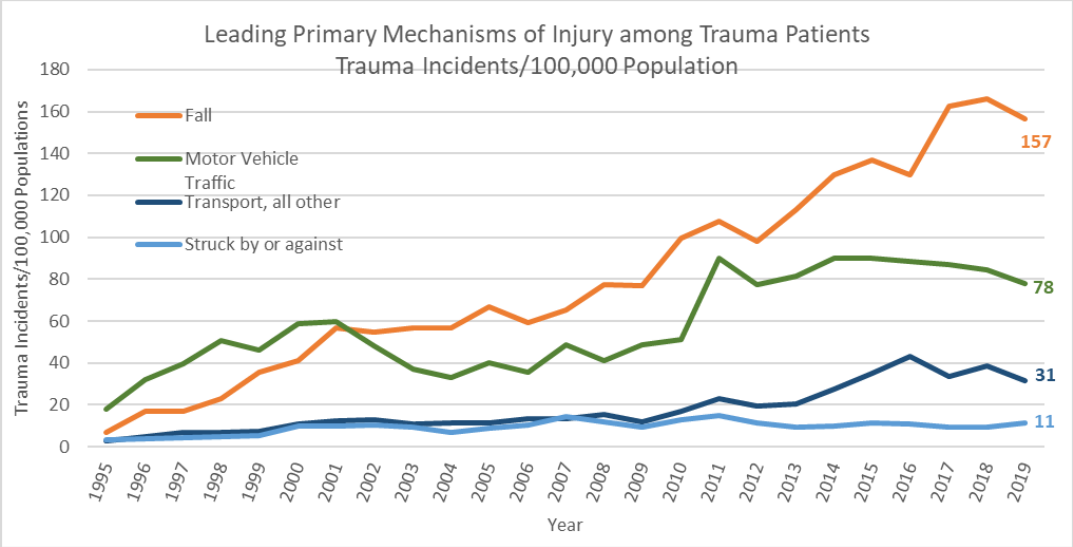

Figure 10 Leading Primary Mechanism of Injury, South Central Region,1995-2019

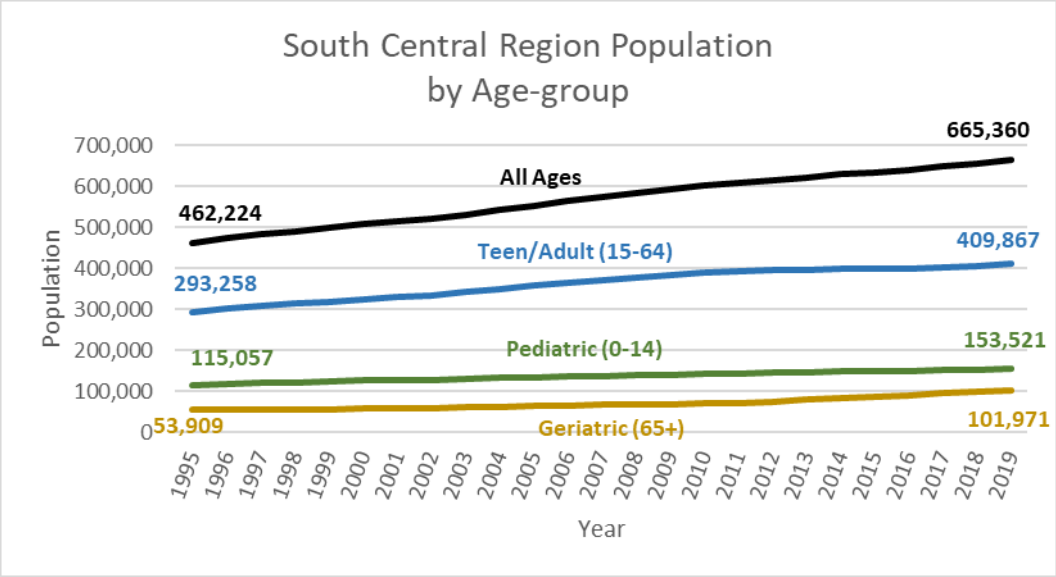

Figure 11 South Central Region Population by Age-group, 1995-2019

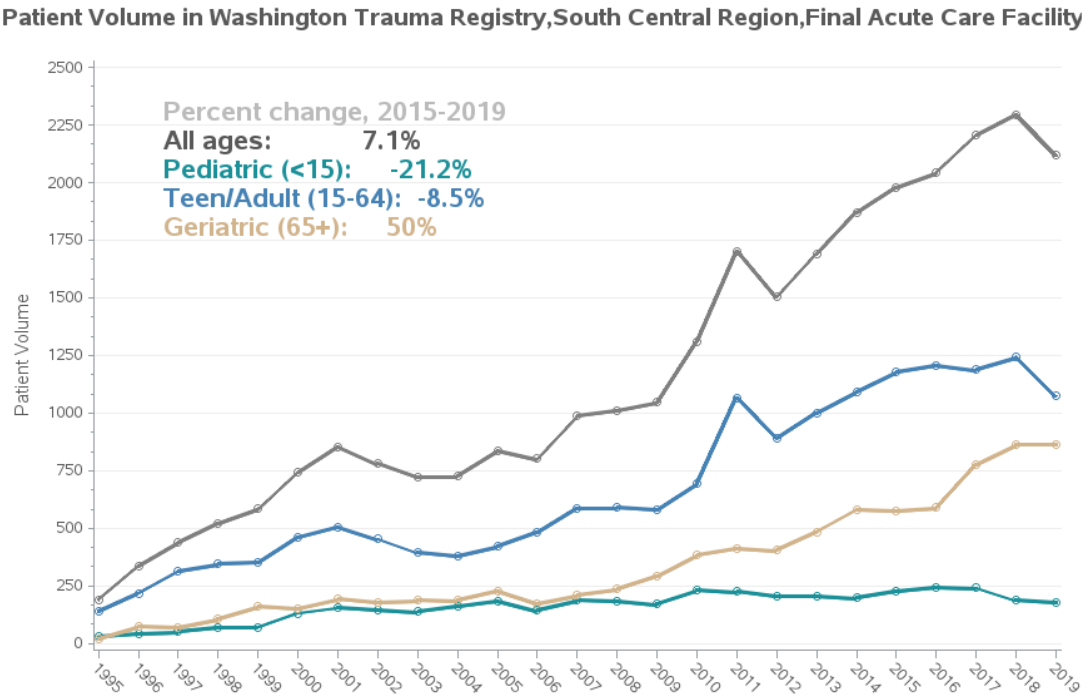

Figure 12 Trauma Volume by Age-group, South Central Region

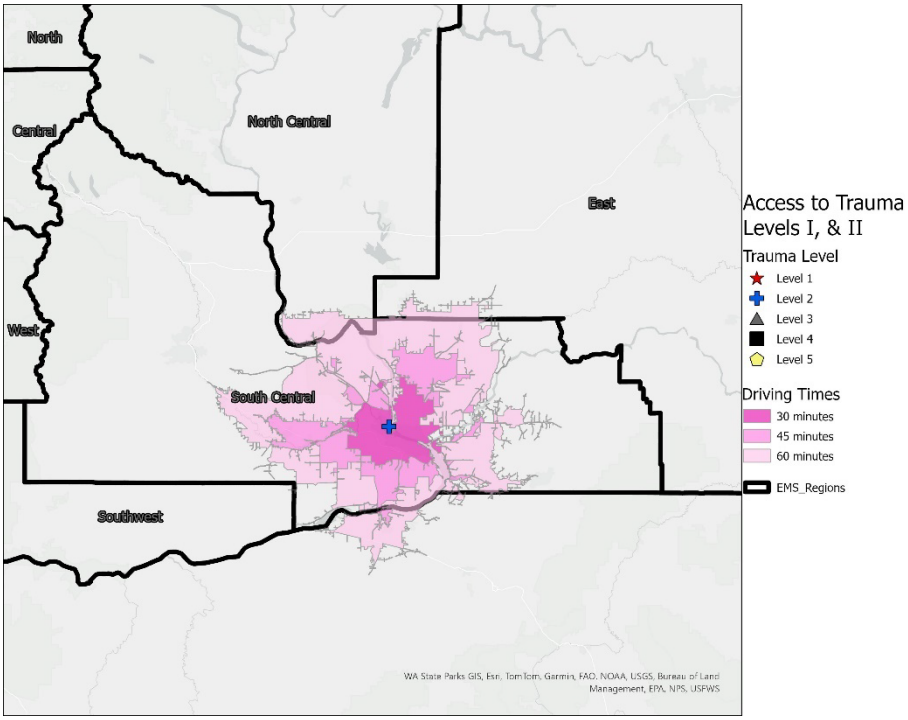

Figure 13 Trauma Levels I &II Driving Times to facilities within South Central Region

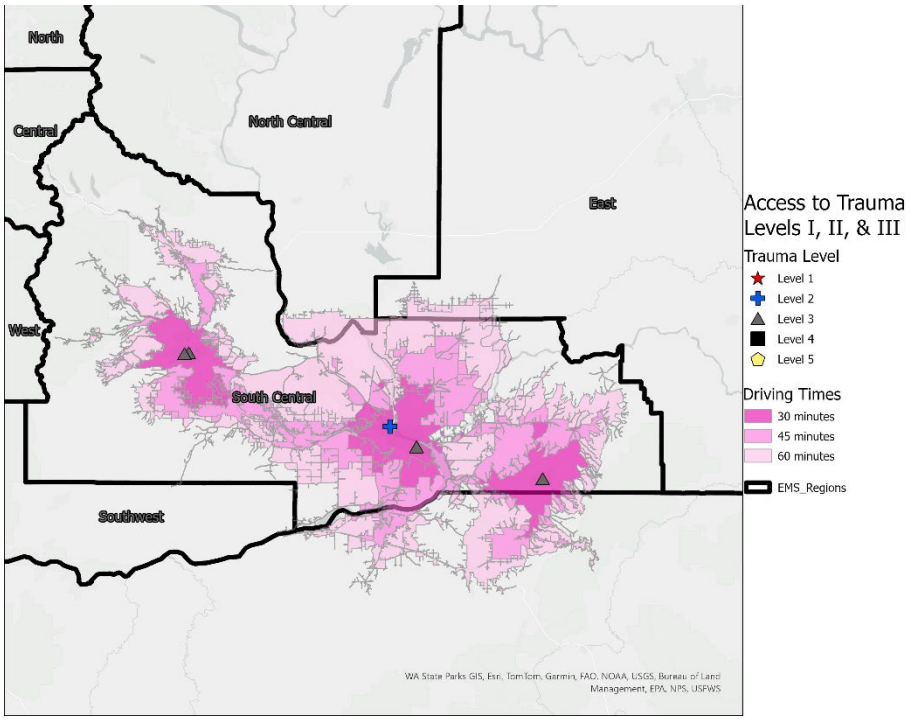

Figure 14 Trauma Levels I, II, & III Driving Times to facilities within South Central Region

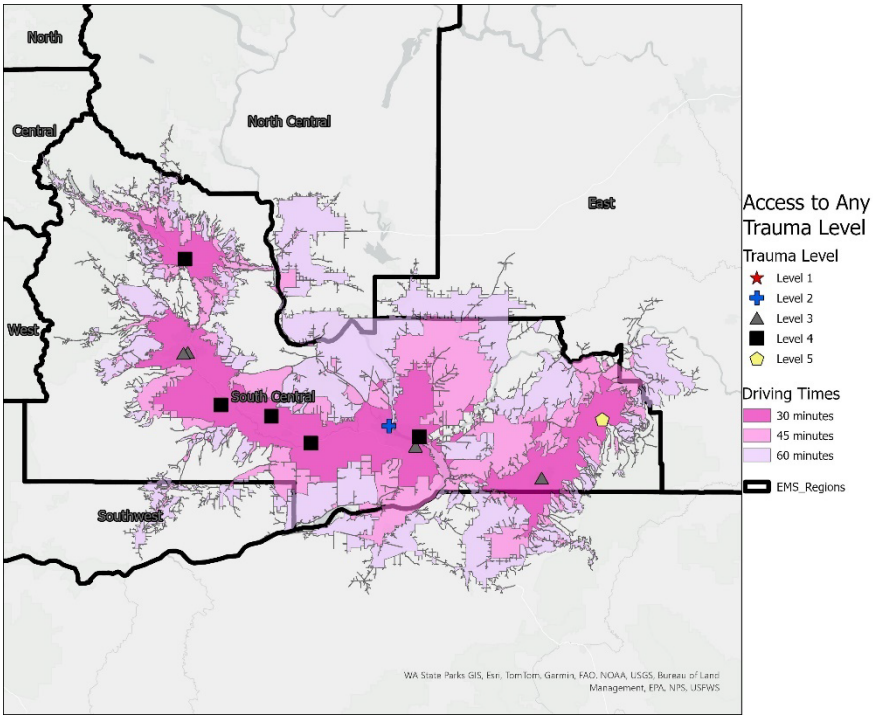

Figure 15 Any Trauma Level Driving Times to facilities within South Central Region

Population within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
South Central	≤30 min%	38%	78%	96%
	≤45 min%	46%	92%	98%
	≤60 min%	53%	98%	99%

Figure 16 South Central Region population within driving distances to trauma center

Percent of trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
South Central	≤30 min%	33%	84%	95%
	≤45 min%	38%	93%	98%
	≤60 min%	42%	98%	99%

Figure 17 South Central Region trauma incidents within driving distances to trauma centers

Percent of Severe Trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
South Central	≤30 min%	18%	79%	95%
	≤45 min%	22%	94%	99%
	≤60 min%	32%	97%	99%

Figure 18 South Central Region severe trauma incidents within driving distances to trauma centers

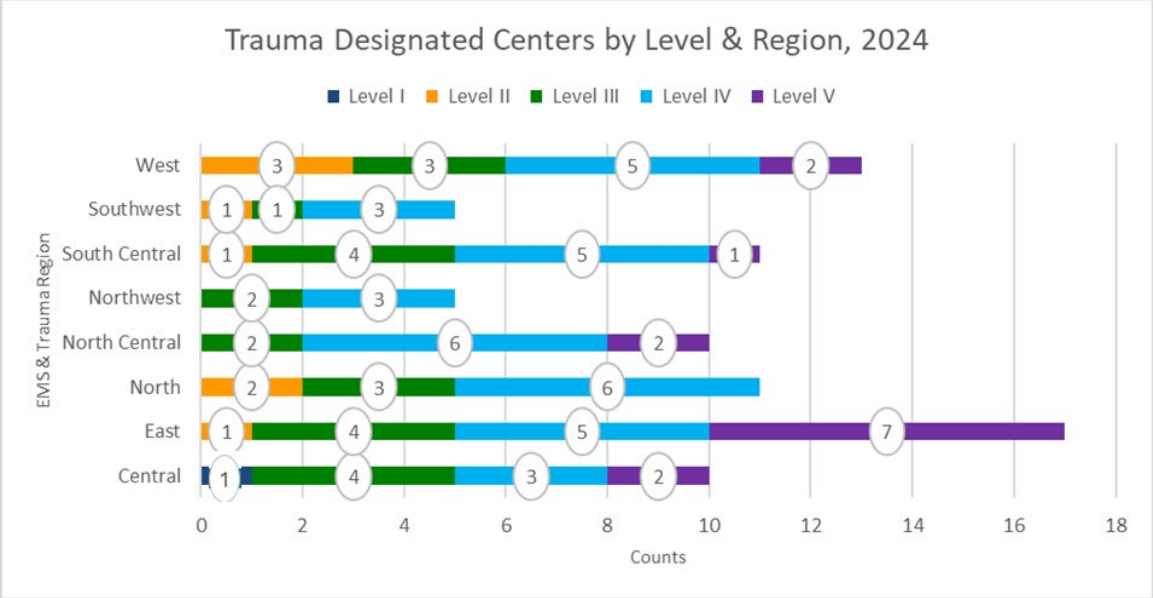

Figure 19 Trauma Designated Centers by Level & Region, 2024

Trauma Patients Initial and Highest Designated Level of Care (%), South Central Region, 2019

		Highest Level of Care				
		Level I	Level II	Level III	Level IV	Level V
Initial Level of Care	Level I	100%	-	-	-	-
	Level II	-	100%	-	-	-
	Level III	15%	6%	79%	-	-
	Level IV	22%	7%	9%	62%	-
	Level V	10%	10%	20%	-	60%

Figure 20 Trauma Patients Initial & Highest Designated Level of Care (%), South Central Region, 2019

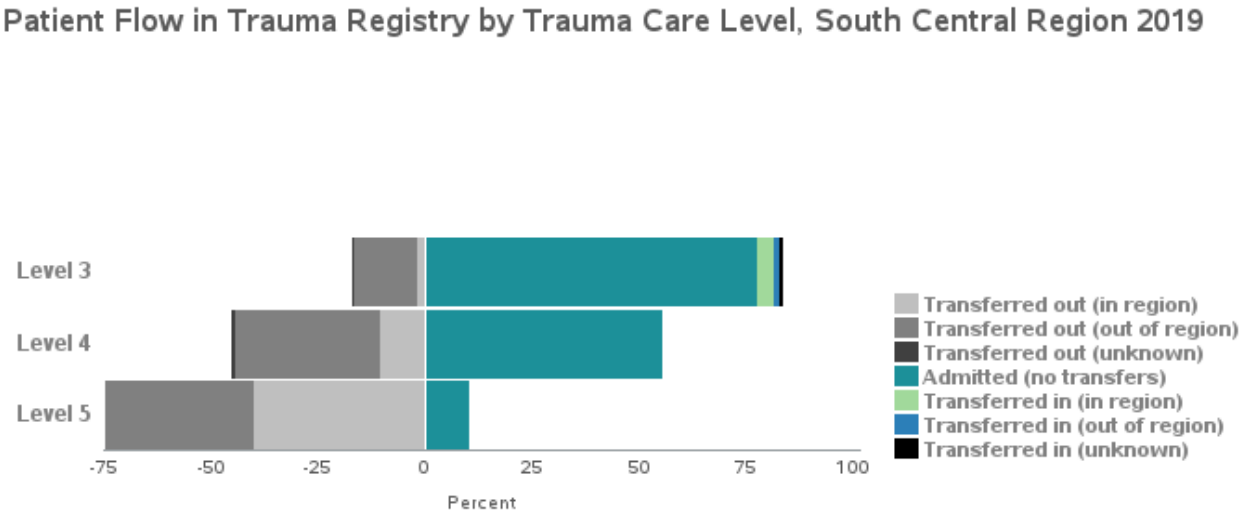

Figure 21 Patient Flow in Trauma Registry by Trauma Level of Care, South Central Region 2019

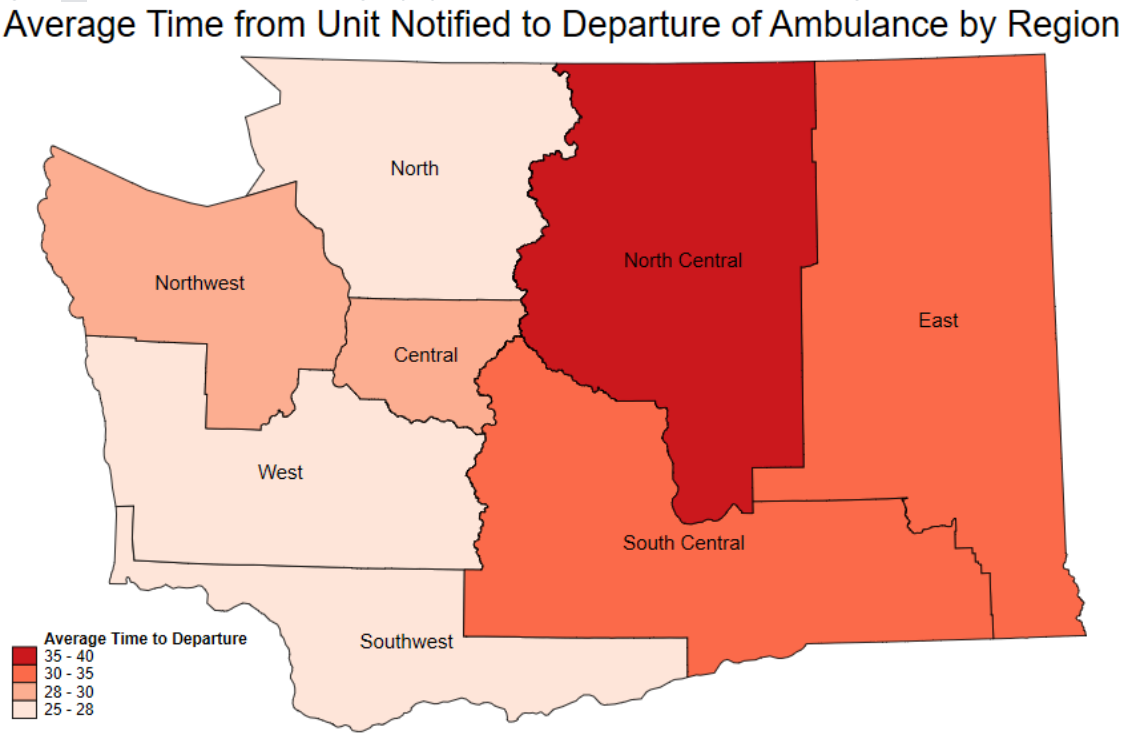

Figure 22 Average Time from EMS Unit Notification to Scene Departure by Region

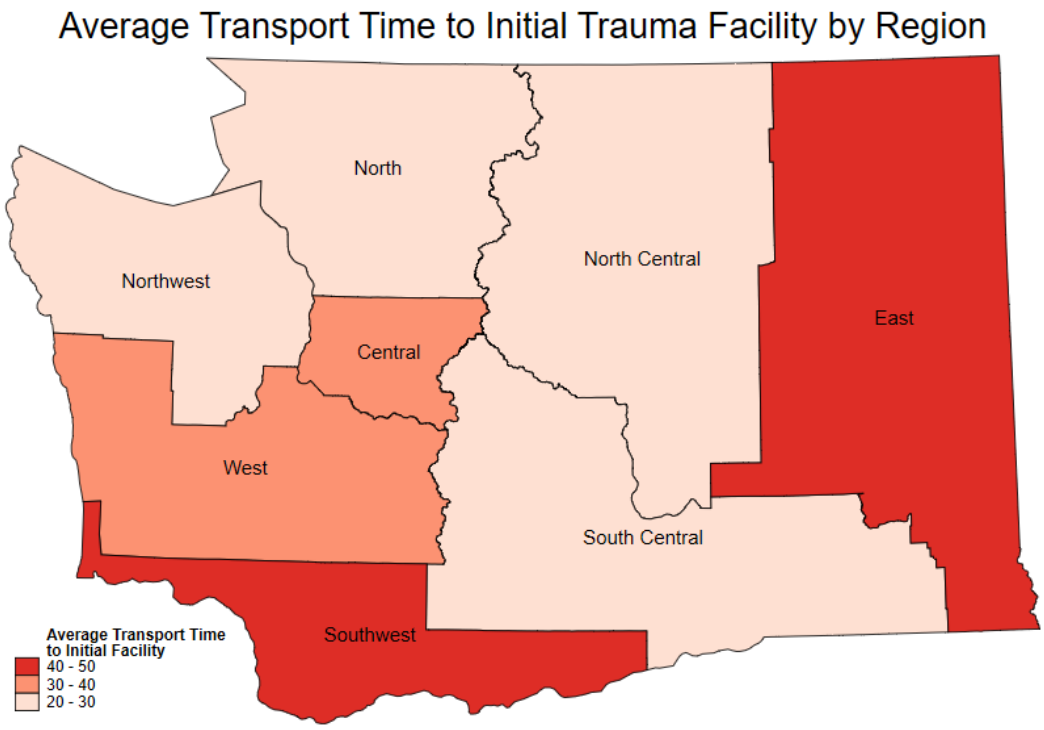

Figure 23 Average Transport Time from Scene Departure to Initial Facility by Region

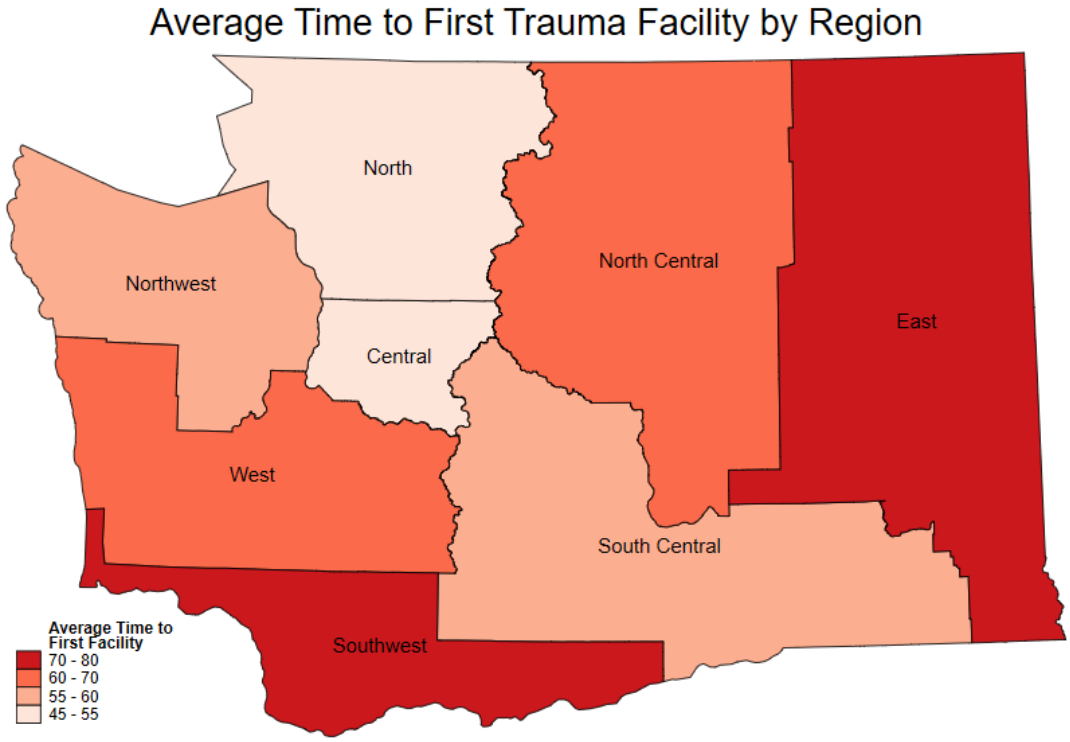

Figure 24 Average Time from EMS Unit Notification to First Trauma Facility by Region

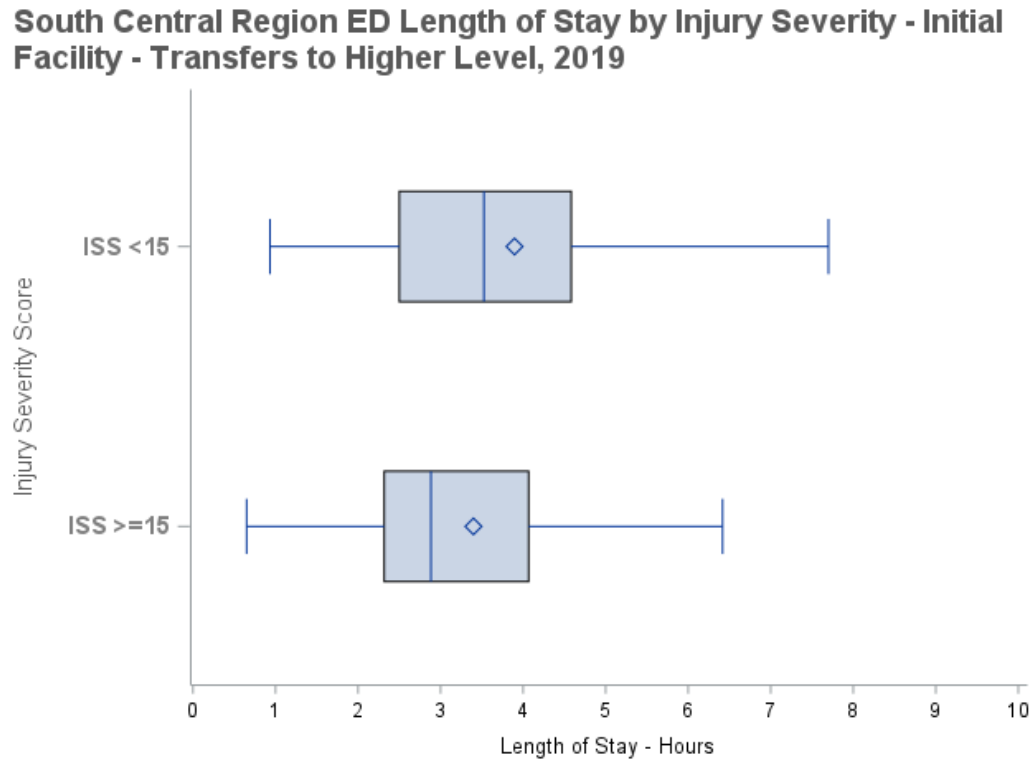

Figure 25 South Central region Emergency Department Length of Stay at Initial Facility, Patients Transferred to Higher Level of Care, by ISS

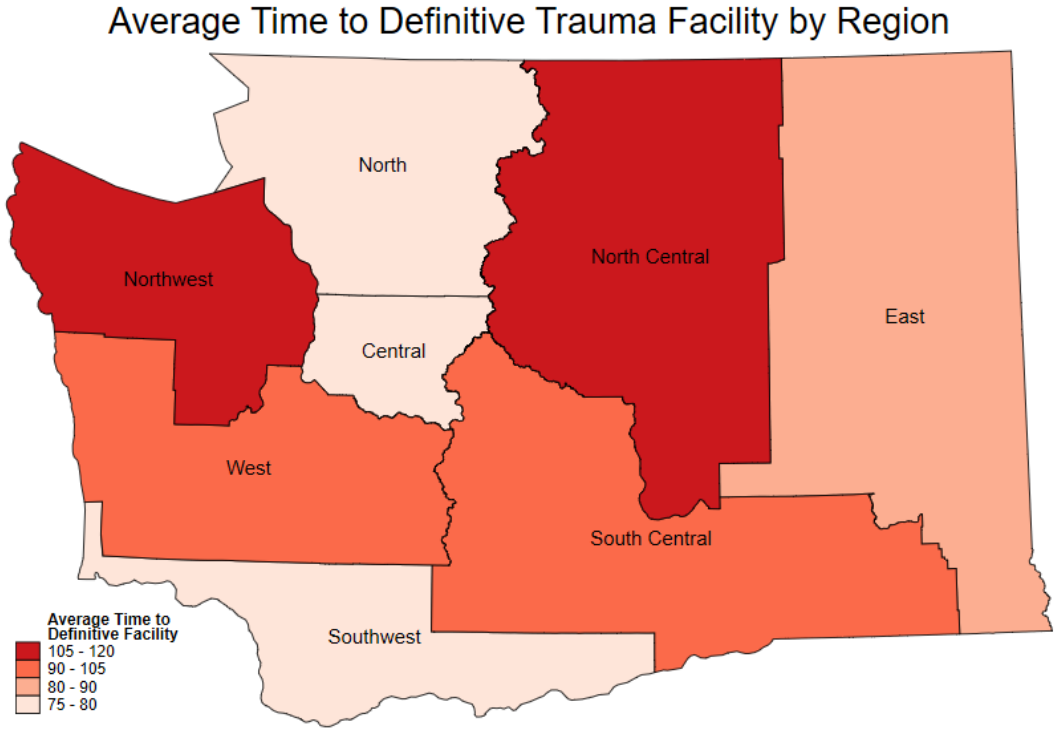

Figure 26 Average Time from EMS Unit Notification to Definitive Trauma Facility by Region

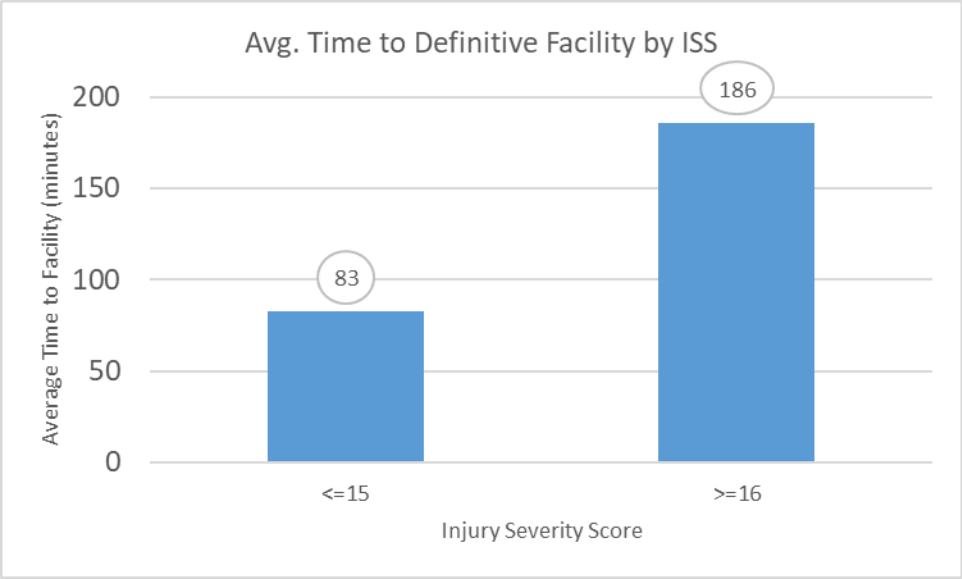

Figure 27 Average Time to Definitive Trauma Facility by Injury Severity Score, South Central Region

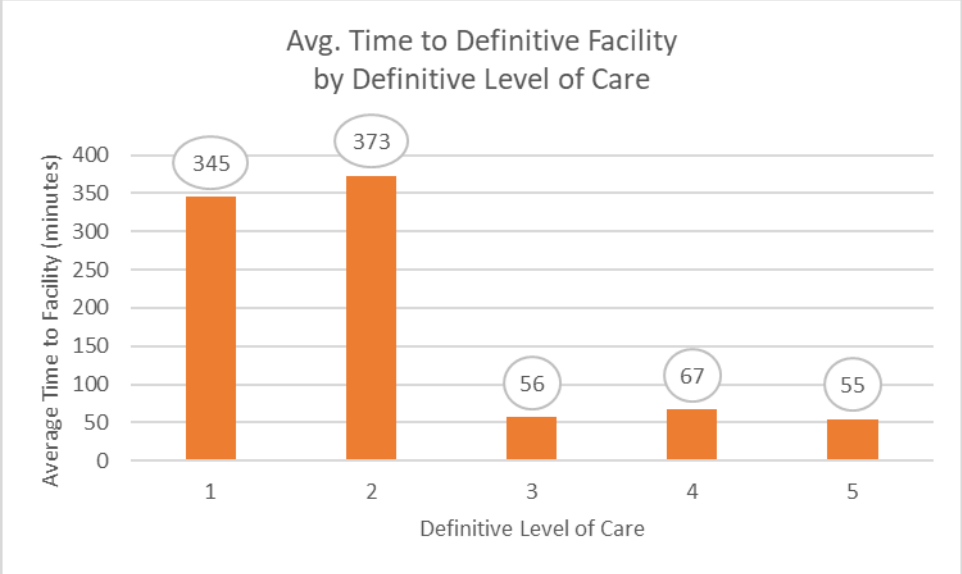

Figure 28 Average Time to Definitive Care by Level of Definitive Facility, Central Region

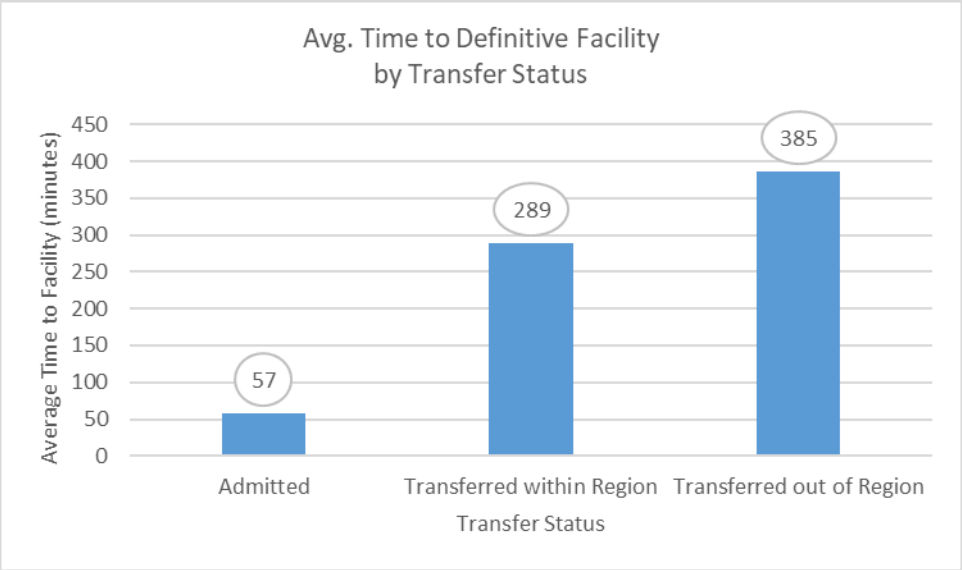

Figure 29 Average Time from EMS Unit Notification to Definitive Facility by Transfer Status, South Central Region, 2019

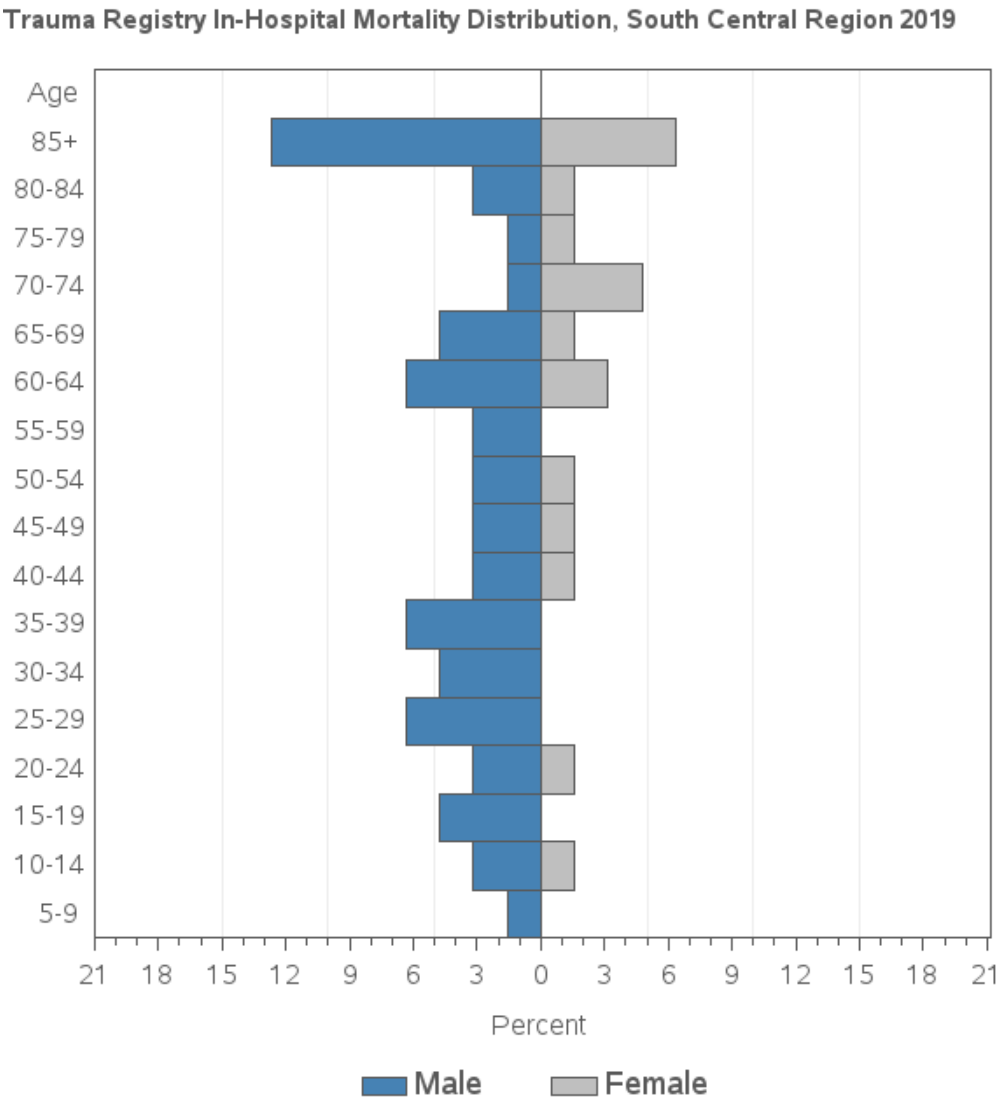

Figure 30 Trauma Registry In-hospital Mortality Distribution, South Central Region 2019

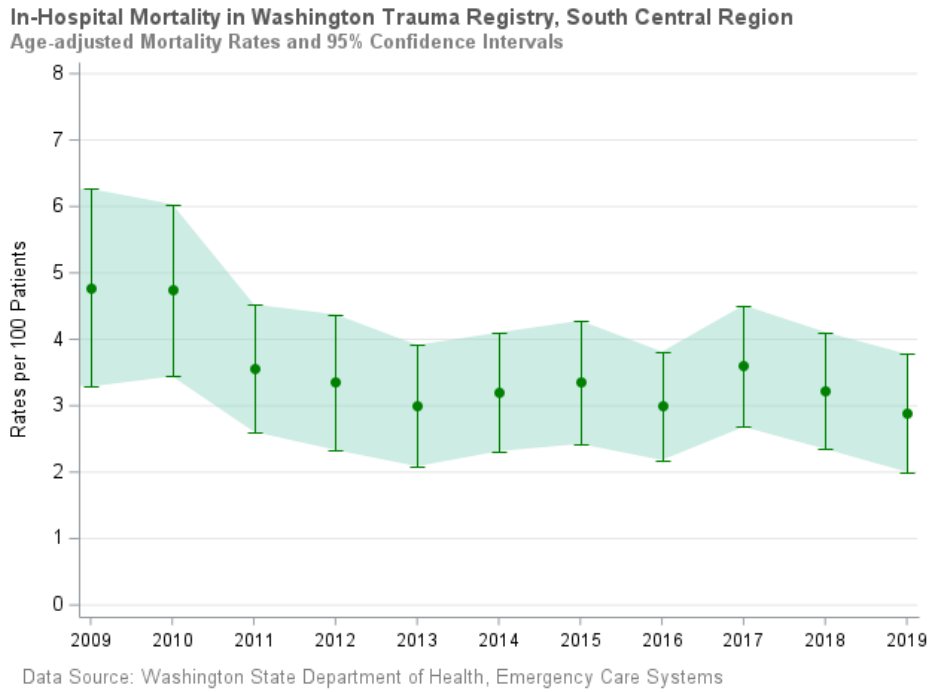

Figure 31 Age-adjusted Mortality Rates in WA Trauma Registry, South Central Region

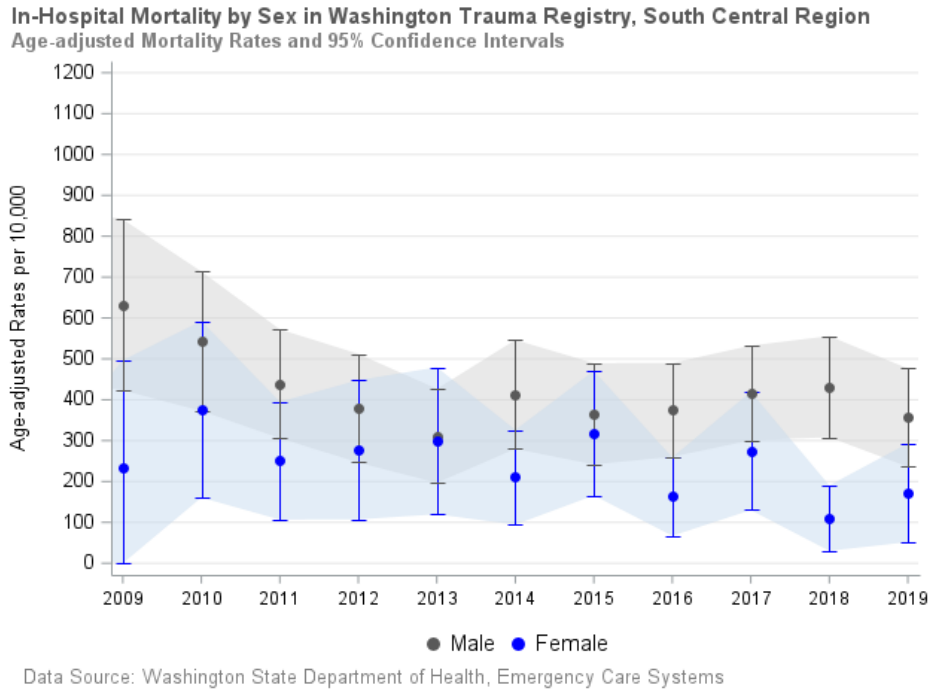

Figure 32 Age-adjusted Mortality Rates by Sex in WA Trauma Registry, South Central Region

West Region data figures and tables

Projected Percent Change in Population by EMS and Trauma Region

Region	Projected Change 2020-2030
West	+18%
State	+10%

Figure 1 Population % Change, 2020-2030, EMS & Trauma Region

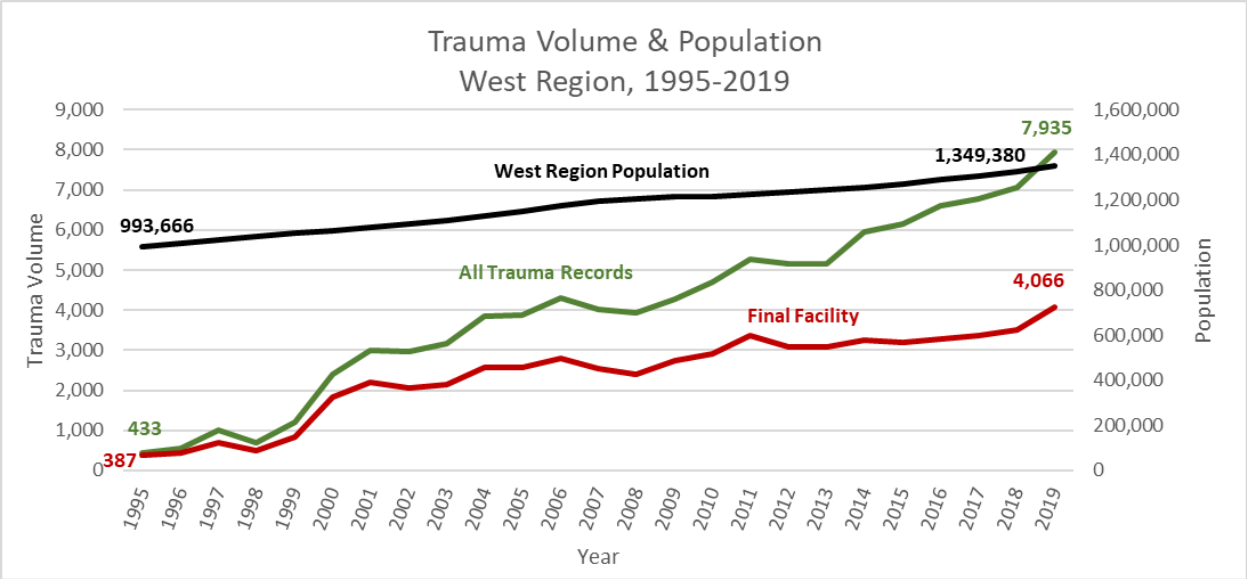

Figure 2 Trauma Volume & Population, West Region 1995-2019

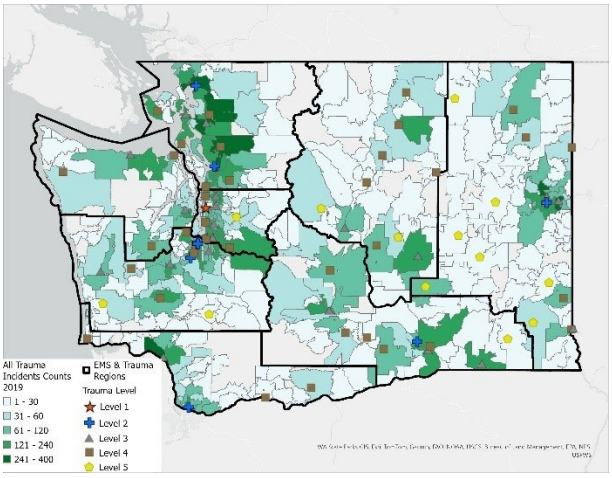

Figure 3 Map of Severe Trauma Distribution by Zip Code, 2019

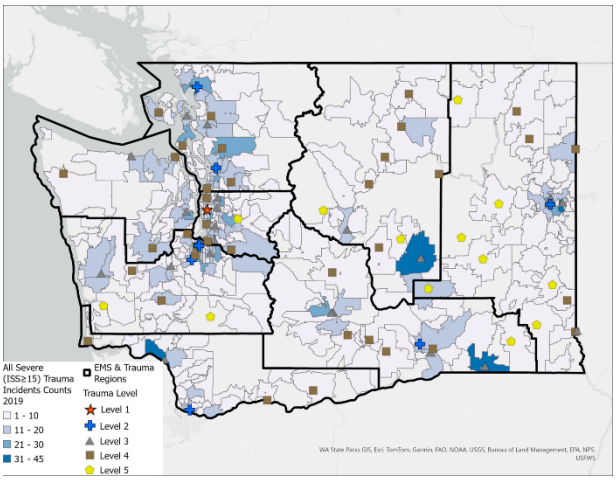

Figure 4 Map of Trauma Distribution by Zip Code, 2019

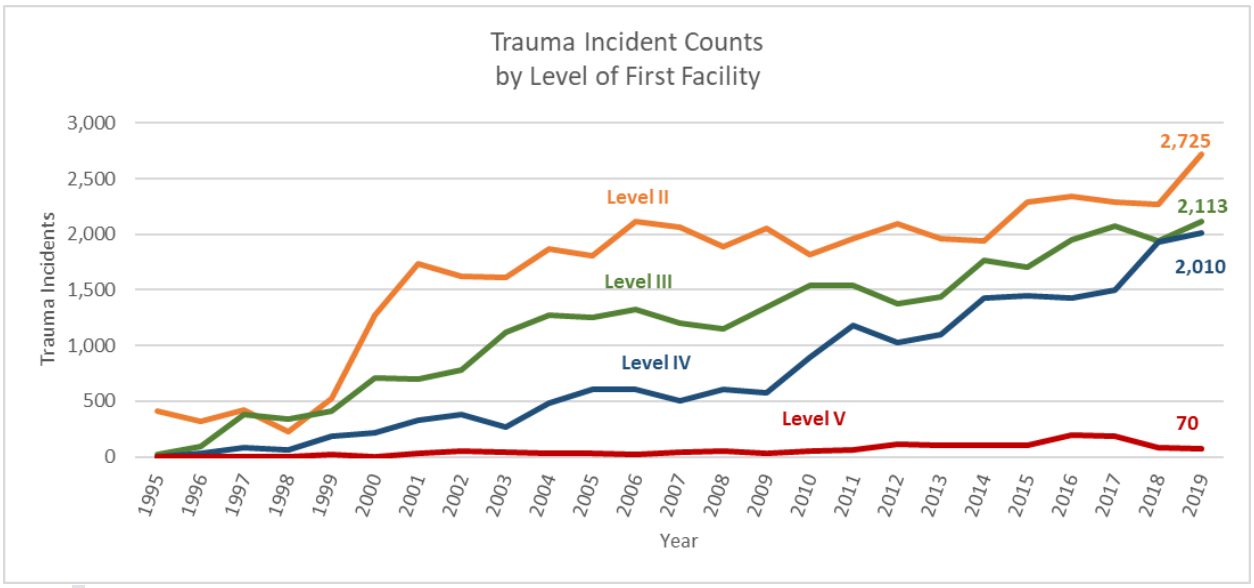

Figure 5 West Region Trauma Incident Counts by Level of First Facility, 1995-2019

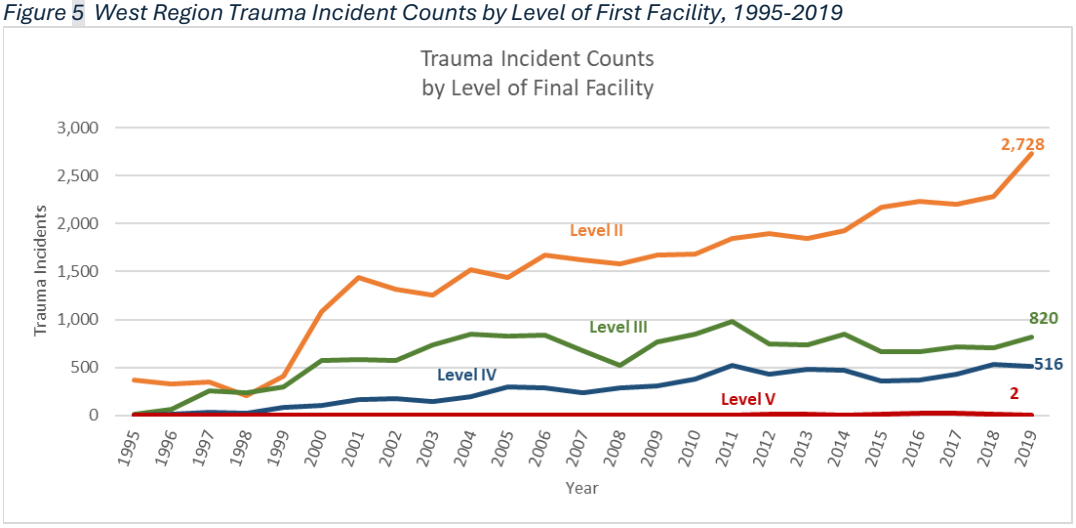

Figure 6 West Region Trauma Incident Counts by Level of Final Facility, 1995-2019

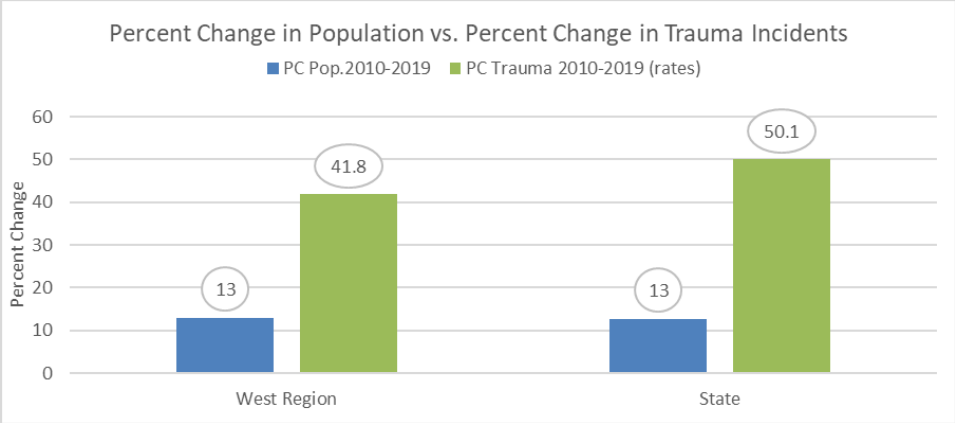

Figure 7 Regional % change in population and trauma incidents, Central Region vs. State

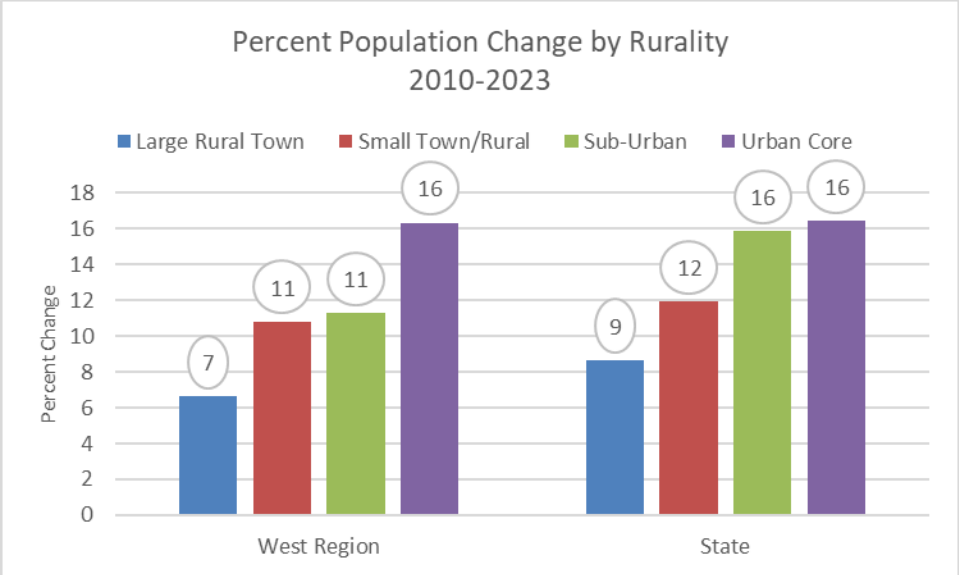

Figure 8 Rurality Population Percent Change, West Region vs. State, 2010-2023

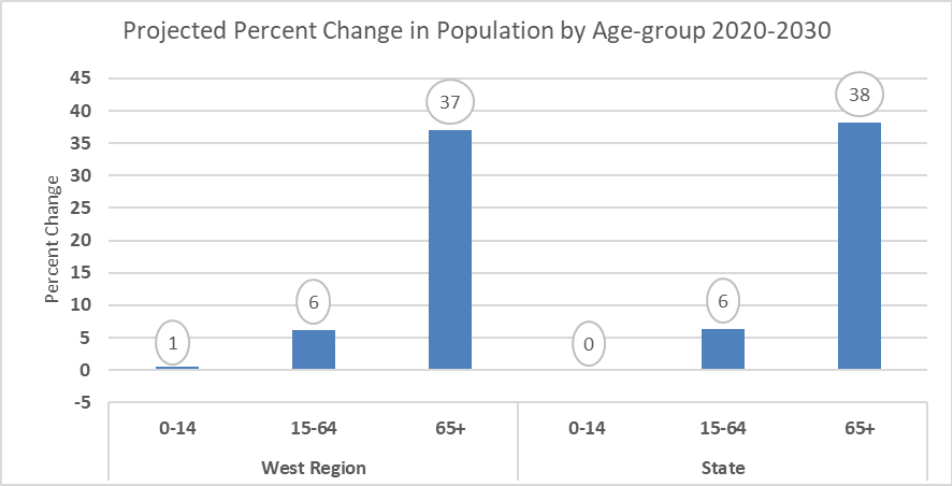

Figure 9 West Region vs. State projected population growth 2020-2030

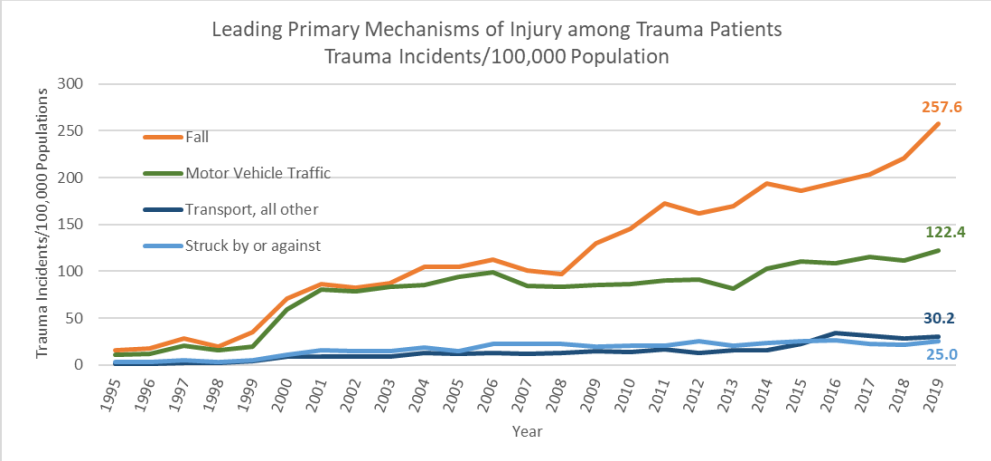

Figure 10 Leading Primary Mechanism of Injury, West Region,1995-2019

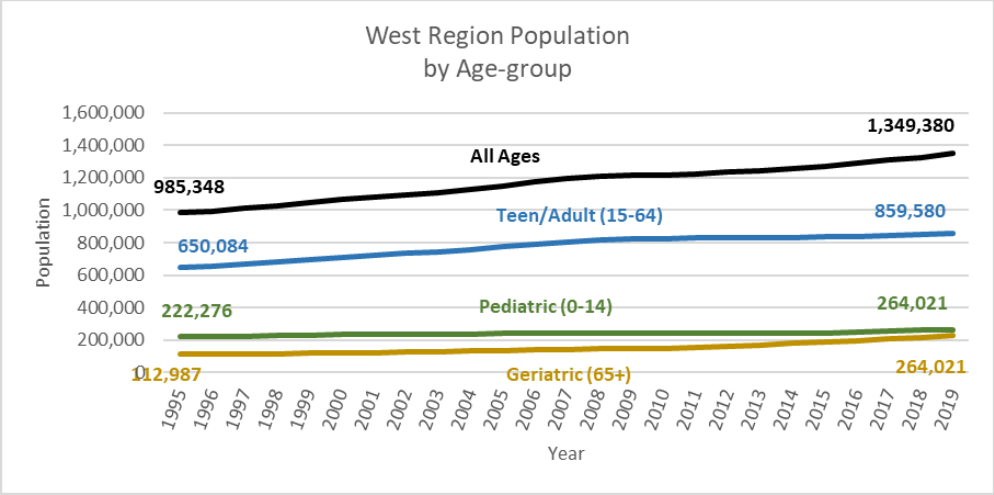

Figure 11 West Region Population by Age-group, 1995-2019

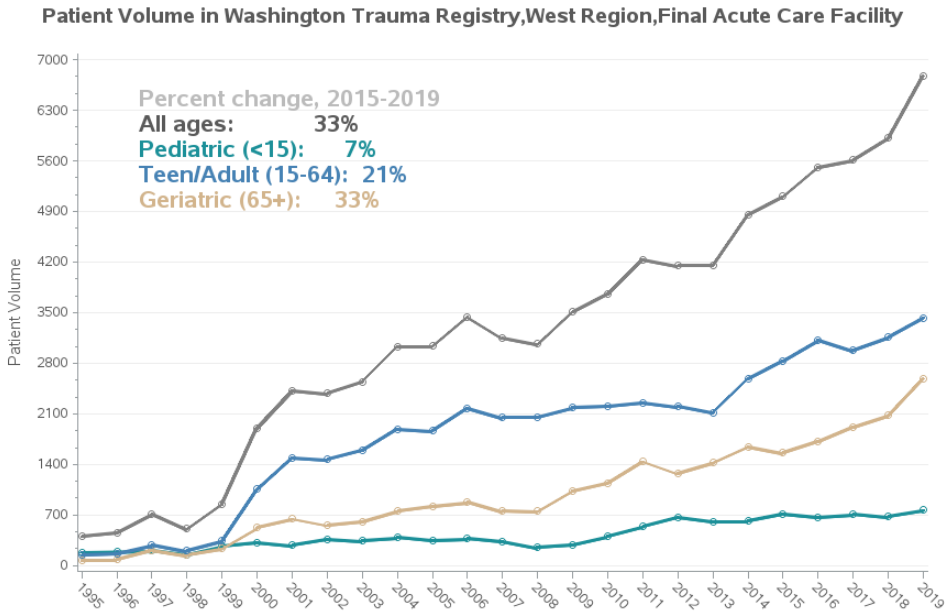

Figure 12 Trauma Volume by Age-group, West Region

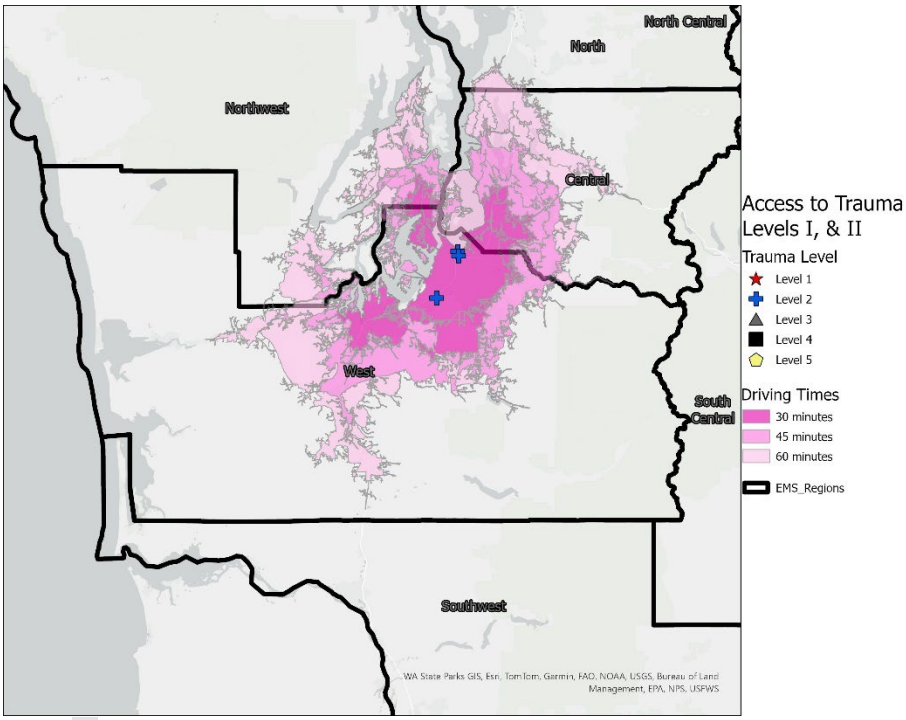

Figure 13 Trauma Levels I &II Driving Times to facilities within West Region

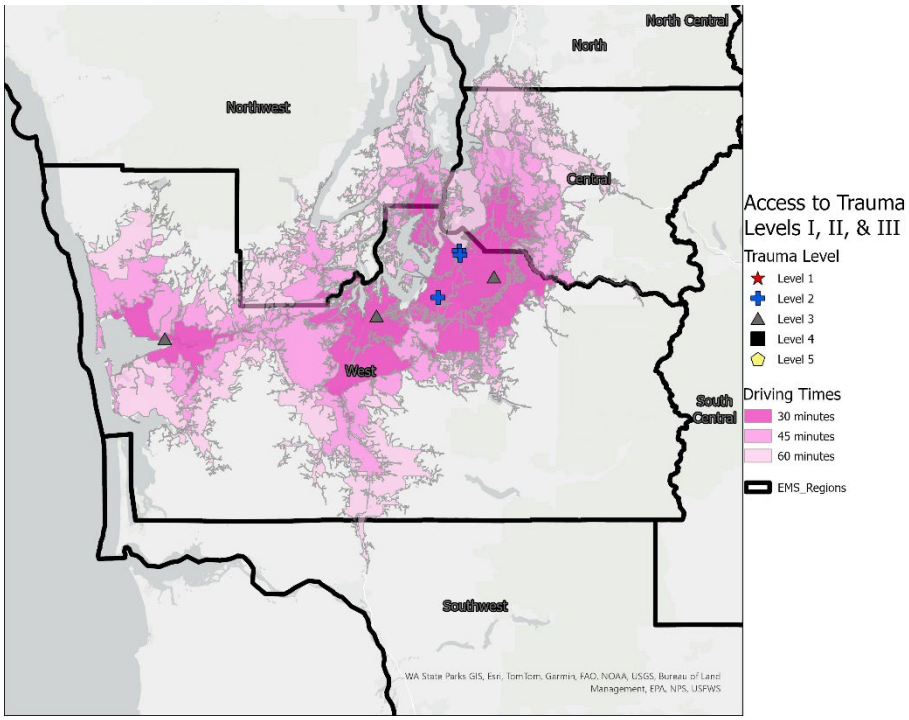

Figure 14 Trauma Levels I, II, & III Driving Times to facilities within West Region

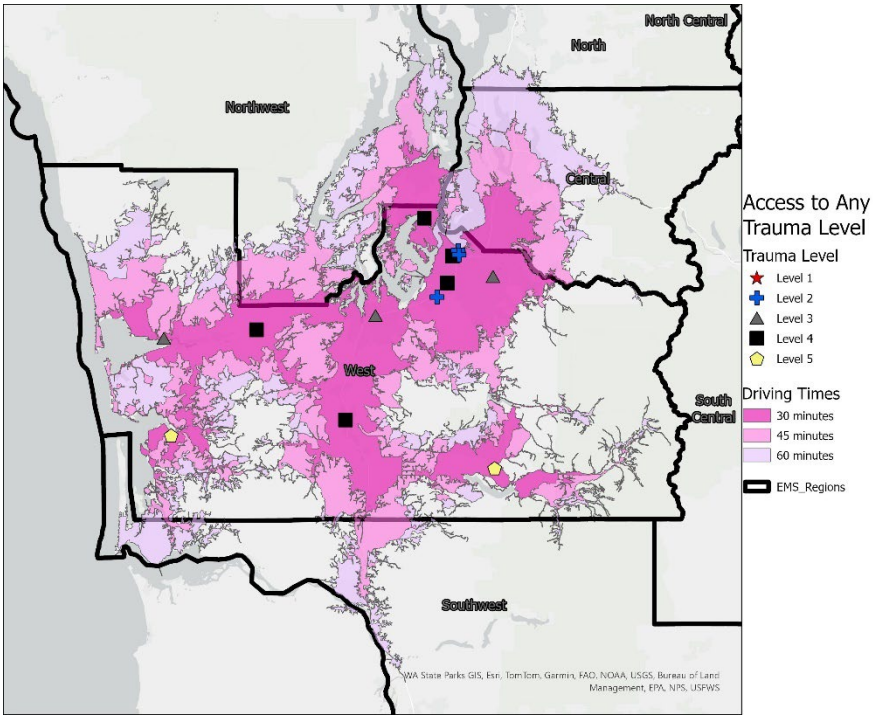

Figure 15 Any Trauma Level Driving Times to facilities within West Region

Population within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
West	≤30 min%	70%	84%	92%
	≤45 min%	86%	95%	98%
	≤60 min%	90%	97%	99%

Figure 16 West Region population within driving distances to trauma center

Percent of trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
West	≤30 min%	72%	84%	95%
	≤45 min%	85%	96%	99%
	≤60 min%	92%	98%	100%

Figure 17 West Region trauma incidents within driving distances to trauma centers

Percent of Severe Trauma Incidents within various driving distances to trauma centers

	Drive Time	Level I & II	Levels I, II, & III	Levels I - V
West	≤30 min%	61%	78%	93%
	≤45 min%	79%	94%	99%
	≤60 min%	89%	99%	100%

Figure 18 West Region severe trauma incidents within driving distances to trauma centers

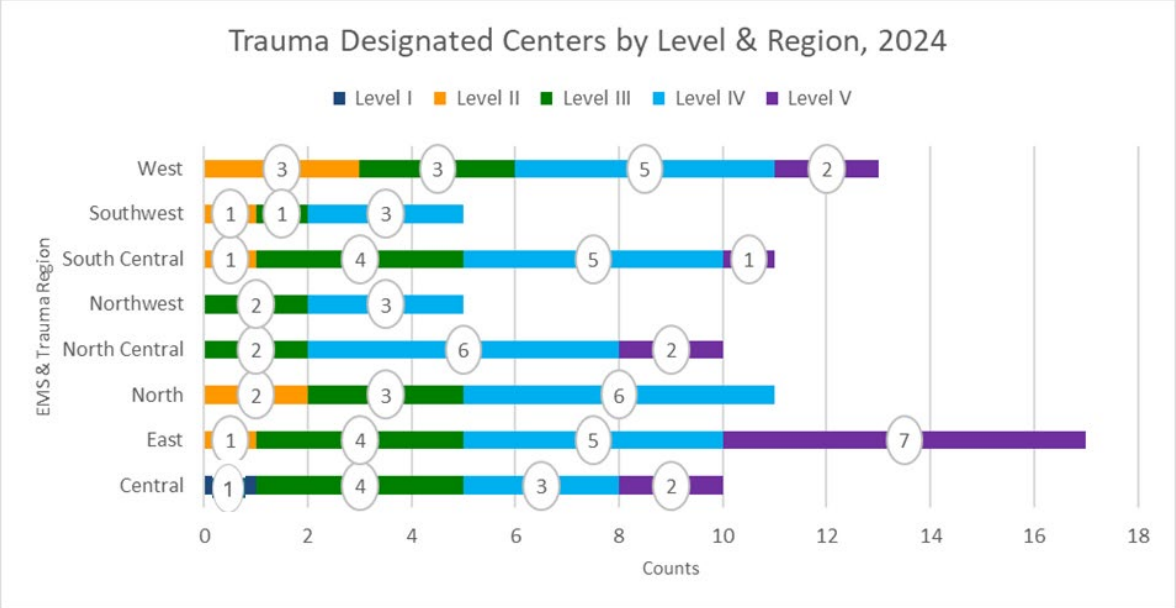

Figure 19 Trauma Designated Centers by Level & Region, 2024

Trauma Patients Initial and Highest Designated Level of Care (%), West Region, 2019

		Highest Level of Care				
		Level I	Level II	Level III	Level IV	Level V
Initial Level of Care	Level I	100%	-	-	-	-
	Level II	4%	96%	-	-	-
	Level III	12%	11%	77%	-	-
	Level IV	6%	27%	-	66%	-
	Level V	21%	28%	-	-	51%

Figure 20 Trauma Patients Initial & Highest Designated Level of Care (%), West Region, 2019

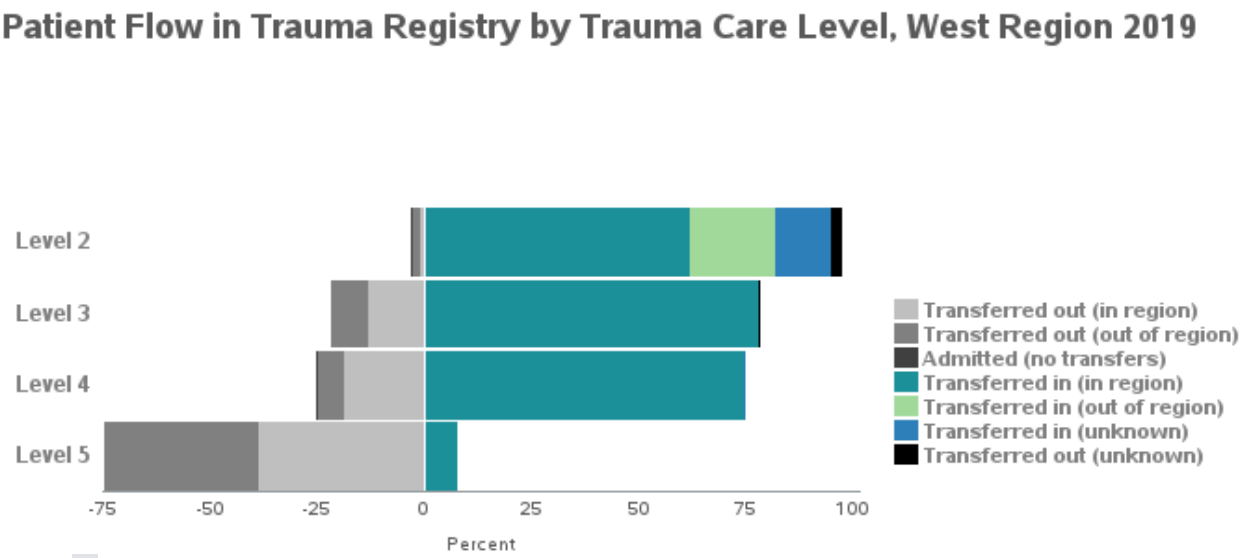

Figure 21 Patient Flow in Trauma Registry by Trauma Level of Care, West Region 2019

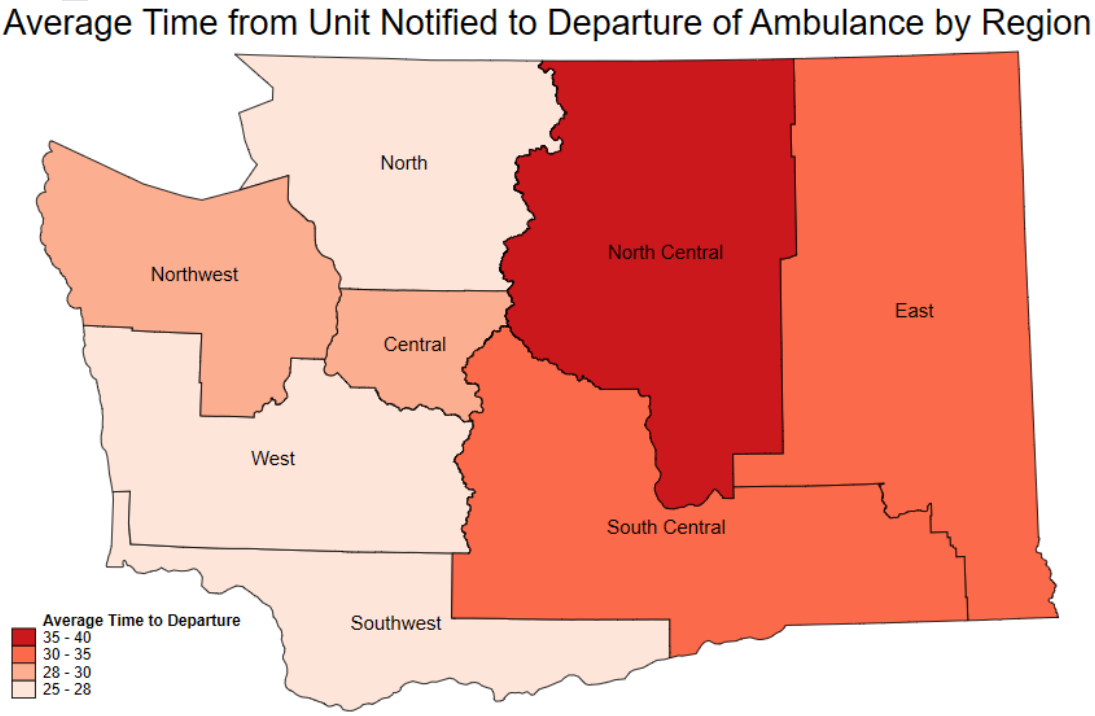

Figure 22 Average Time from EMS Unit Notification to Scene Departure by Region

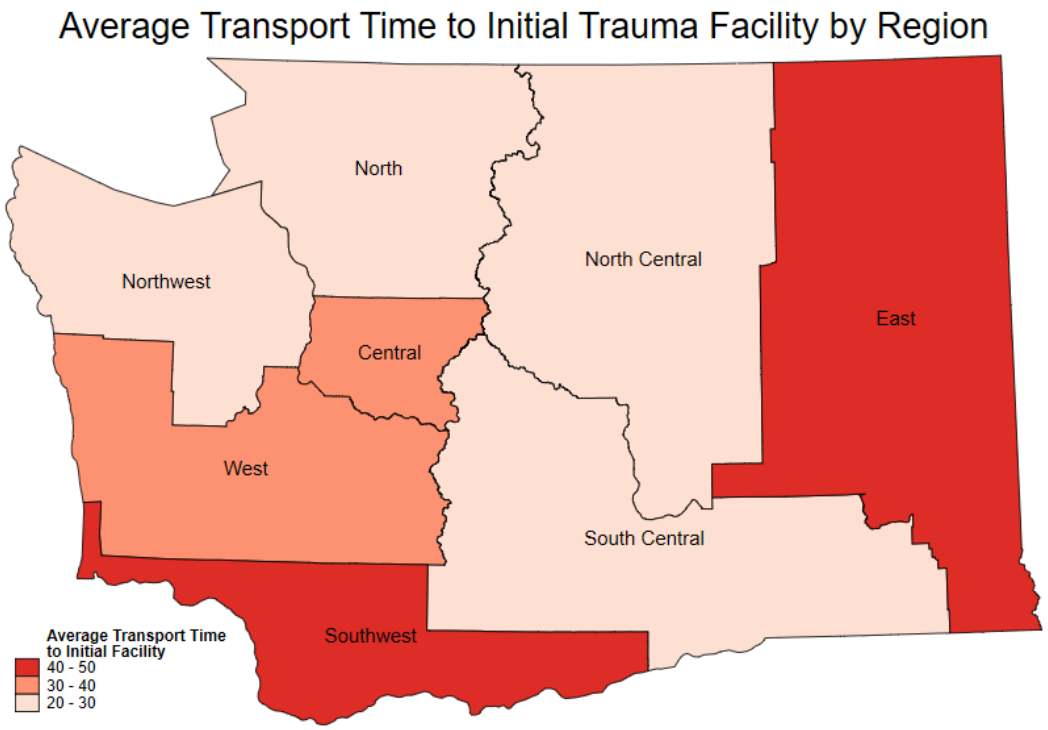

Figure 23 Average Transport Time from Scene Departure to Initial Facility by Region

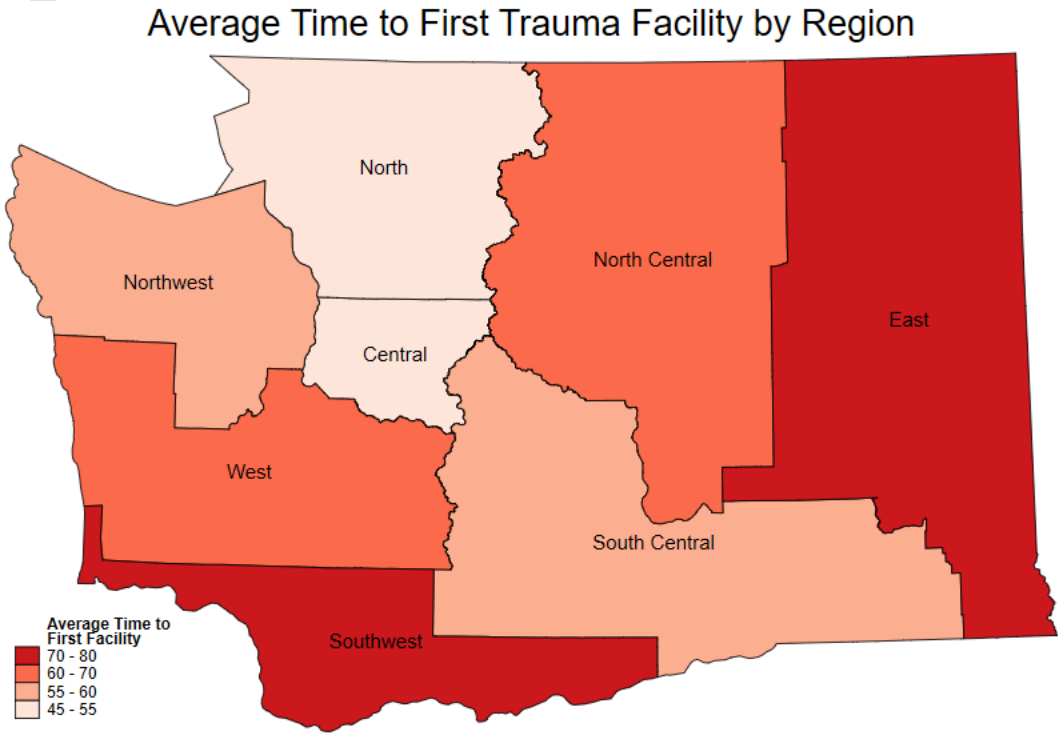

Figure 24 Average Time from EMS Unit Notification to First Trauma Facility by Region

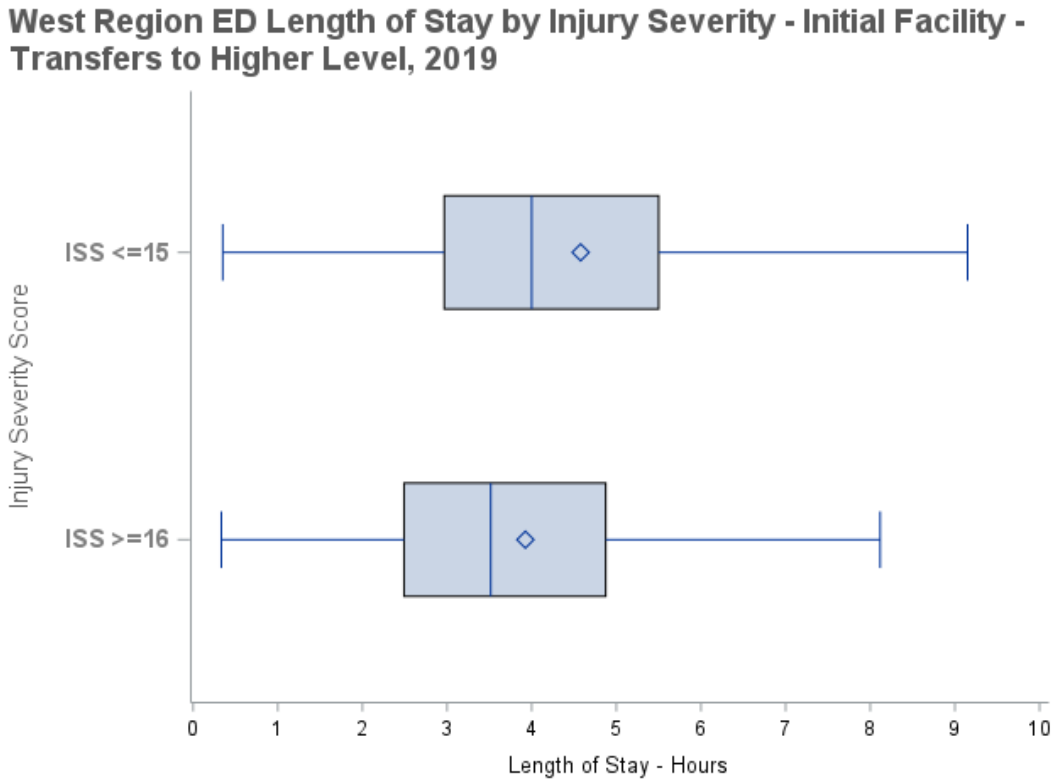

Figure 25 Regional Emergency Department Length of Stay at Initial Facility, Patients Transferred to Higher Level of Care, by ISS

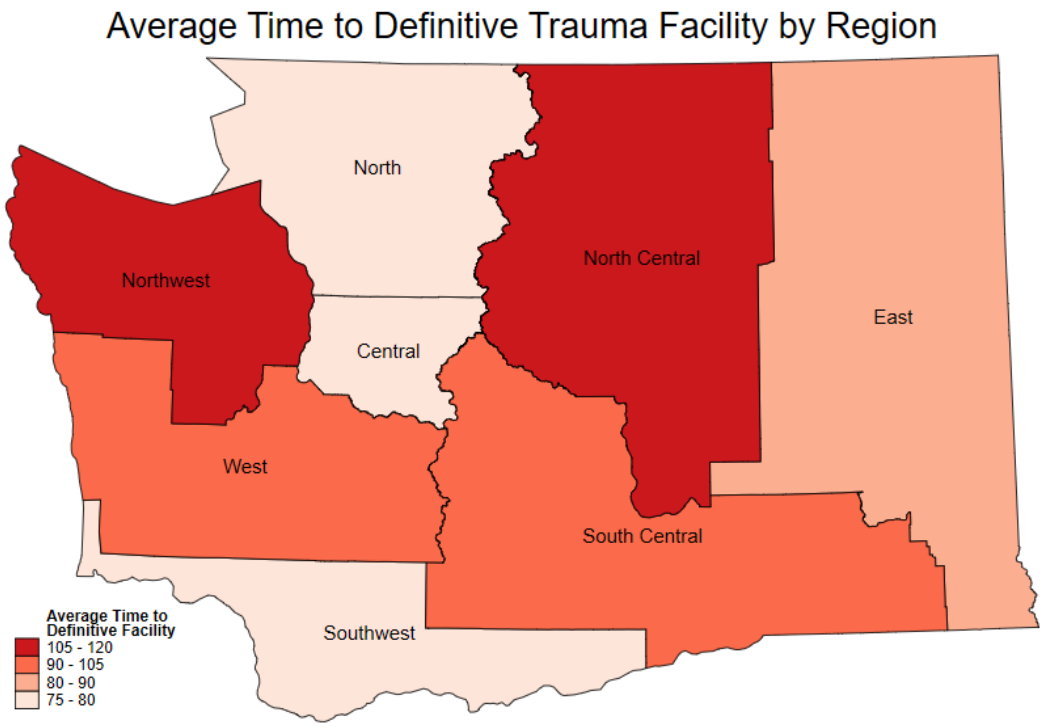

Figure 26 Average Time from EMS Unit Notification to Definitive Trauma Facility by Region

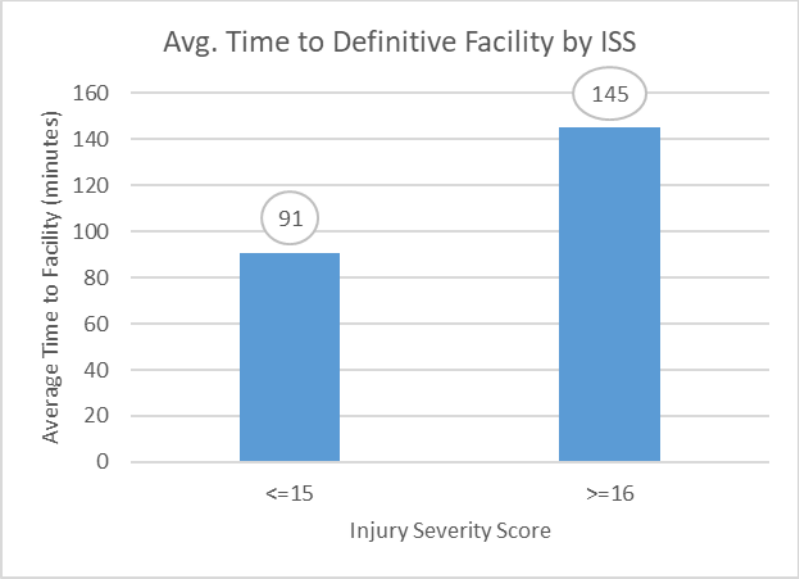

Figure 27 Average Time from EMS Unit Notification to Definitive Trauma Facility by Injury Severity Score, West Region

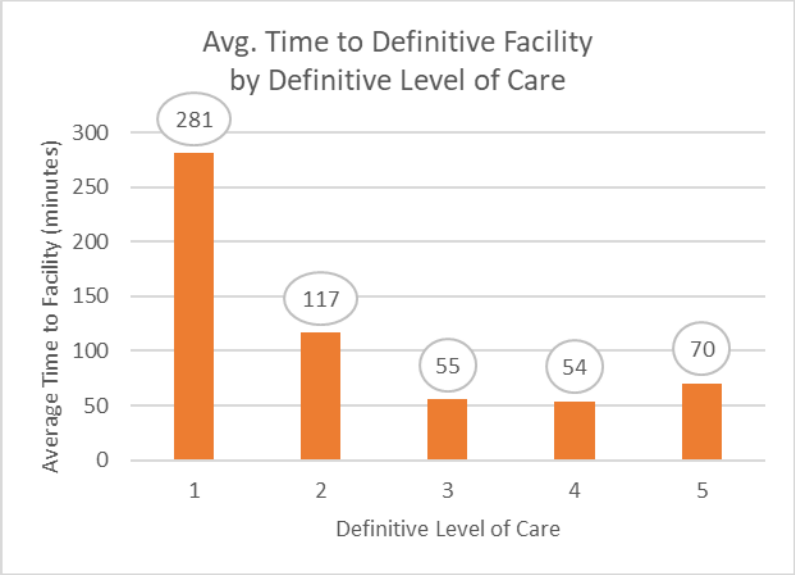

Figure 28 Average Time from EMS Unit Notification to Definitive Care by Level of Definitive Facility, West Region, 2019

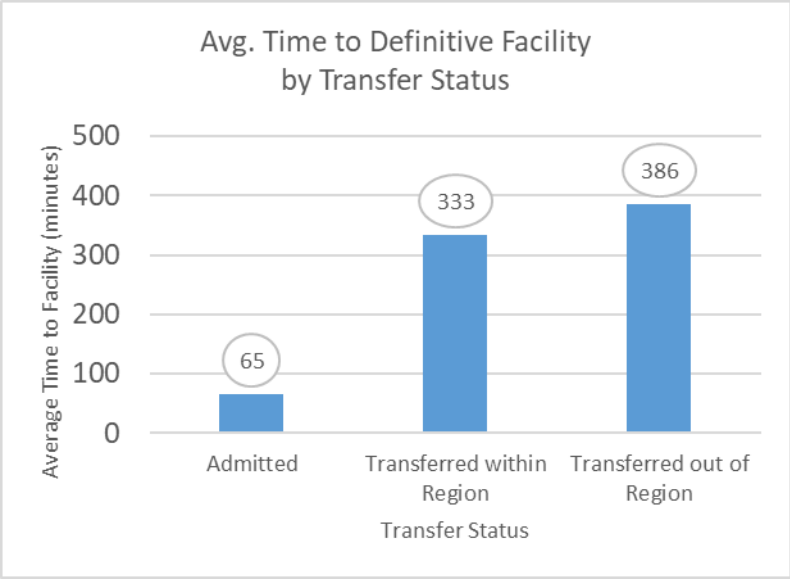

Figure 29 Average Time from EMS Unit Notification To Definitive Facility by Transfer Status, West Region, 2019

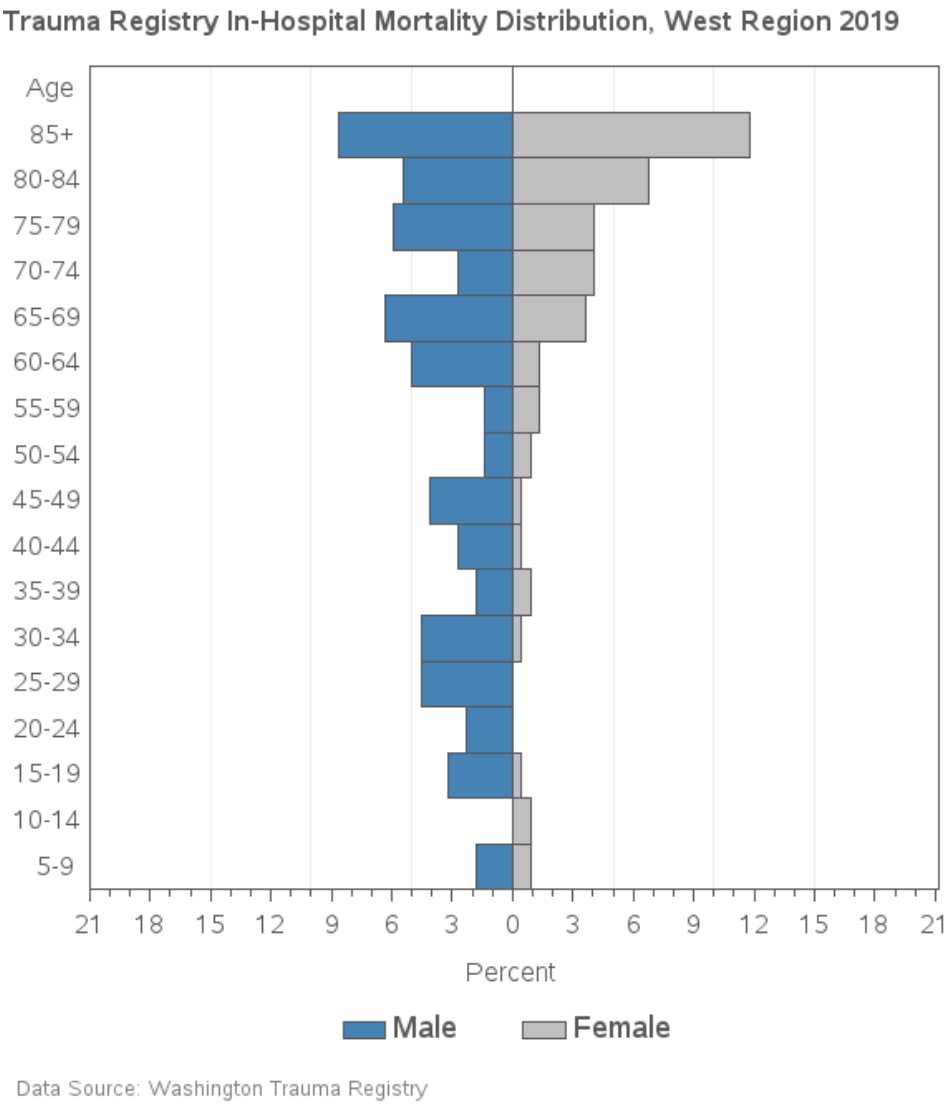

Figure 30 Trauma Registry In-hospital Mortality Distribution, West Region 2019

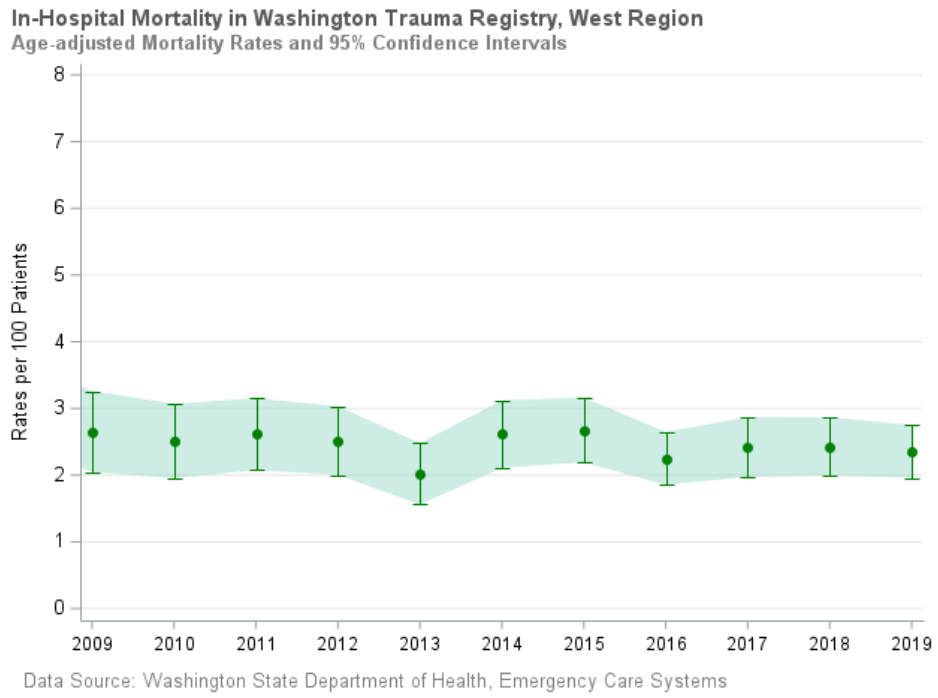

Figure 31 Age-adjusted Mortality Rates in WA Trauma Registry, West Region, 2019

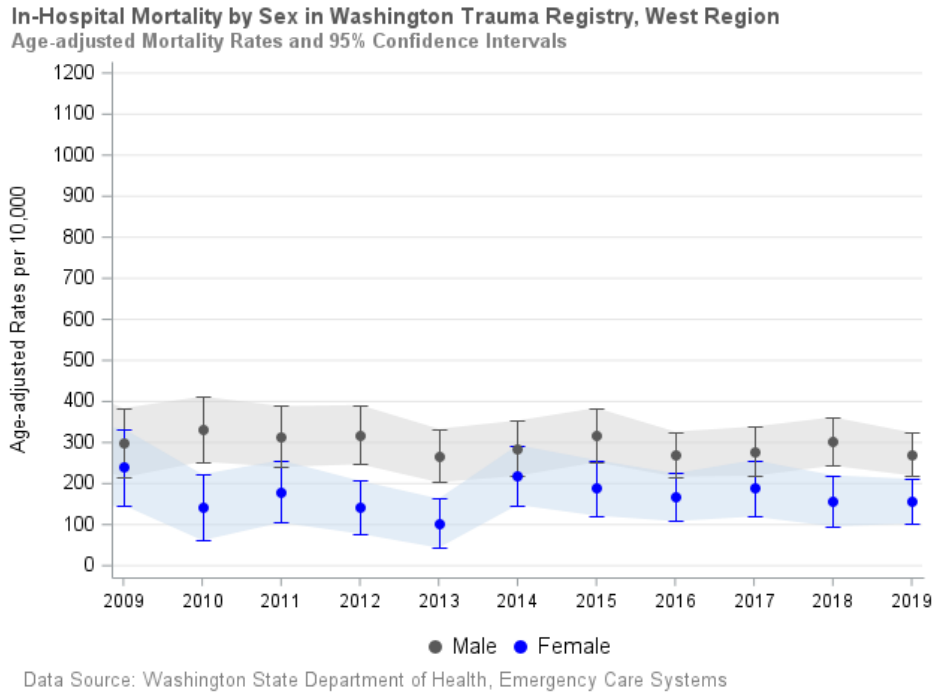

Figure 32 Age-adjusted Mortality Rates by Sex in WA Trauma Registry, West Region, 2019

G. External Reviewer Reports

In June and July 2024, three renowned trauma leaders from across the nation collaborated with the Department to review the draft Trauma System Assessment and provide input and recommendations for improvement.

Each expert studied the history of the Washington State EMS & Trauma Care System, the ACS Assessment and Recommendations, Summary of Public Forum Input, Min/Max workgroup documents and reports, along with the draft Trauma System Assessment. The expert external review team met with the department on several occasions throughout this process for technical support and clarifications to inform their final written reports and recommendations.

Expert input and feedback on the assessment was provided in consideration of the of the following:

- Alignment with 2019 ACS Assessment and recommendations
- Alignment with 2021 Min/Max workgroup recommendations
- Ability to support Regional EMS & Trauma Care Councils in using the assessment to help inform the need and distribution of statewide trauma services
- Ability to support the department's decision making related to the number and distribution of trauma services
- Ability to support statewide trauma program planning activities

Expert Biographies:

Dr. Robert J. Winchell, MD, FACS

Dr. Winchell is an internationally renowned expert in care of the critically injured and the development, design, and operation of trauma systems. Professor of surgery at Weill Cornell Medicine. He heads trauma surgery at New York-Presbyterian Hospital and oversees William Randolph Hearst Burn Center.

Dr. Winchell participated in the 2019 Washington ACS Assessment as the "Needs Assessment Reviewer". He has extensive experience in state trauma system assessments and has several publications related to geospatial analysis and determining the locations of trauma hospitals. Dr. Winchell has practice as a trauma surgeon in Washington and is familiar with the state trauma system.

Dr. Marco J. Bonta, MD, MBA, FACS

Dr. Bonta currently serves as the System Chief for Ohio Health Trauma and Trauma Medical Director at Riverside Methodist Hospital. Dr. Bonta has 37 years as a surgeon, and he has many years of experience as a Trauma Medical Director. Dr. Bonta also conducts trauma verification site visits for the American College of Surgeons.

Heidi A. Hotz, RN

Heidi Hotz is an executive trauma nurse leader who oversees the comprehensive Level I trauma program at Cedars-Sinai Medical Center. Heidi has served as a site surveyor in Washington State and was the nurse surveyor from the ACS during our 2019 State Assessment. She was awarded the Eastern Association for the Surgery of Trauma Honorary Membership; being the second nurse to receive this honor. She is a senior survey team member for the American College of Surgeons Trauma Systems and Evaluation Program.

Key Findings / Recommendations:

- The department should more strongly consider the recommendations from the ACS Assessment, Min/Max Workgroup, and other committees.
- There is a need for a state trauma/EMS medical director as recommended in the ACS Assessment.
- The Regional EMS & Trauma Care Councils and Regional EMS & Trauma Quality Improvement Committees must be better supported by the department with more guidance and formalized processes.
- There may be a need to assess the current trauma funding model and direct more resources to specific areas or gaps in the system.
- Consideration should be given to identifying level III facilities with neurosurgical services (ACS Level III-N designation) as a means to better incorporate them into the trauma system and provide more neurosurgical coverage in their region and across the state.
- The statewide Trauma Services Assessment should be used as a guide to support the work of the Regional EMS & Trauma Carer Councils and Regional EMS & Trauma Quality Improvement Committees.
- The statewide Trauma Services Assessment will better support regional decision-making with more current data that is granular and sufficient to identify gaps and make informed decisions regarding the care provided and min/max.
- Triage and transfer decision related data should be reviewed and included in the statewide Trauma Services Assessment with a focus on level II facilities that are routinely bypassed. The cause of the bypass should be thoroughly reviewed and included as part of the assessment.
- There is a need to better identify county and regions with population growth and increasing trauma volumes to ensure attention is directed toward them.
- There may also be a need to develop and apply a more uniform triage and transfer process throughout the state.
- The statewide Trauma Services Assessment should include data related to transfer delays and facility diversion time.

Full External Reviewer Reports:

The three external reviewer reports are provided below in their entirety.

Final Report
Washington State Needs Assessment Review
July 12, 2024

Robert J. Winchell, MD, FACS

Methodology

This report was generated through a process of research and synthesis that includes review of the following documents either provided by the Department of Health of Washington State or available on their website:

- Draft Washington State Trauma Services Assessment 2024
- Final recommendations from the min/max workgroup (version date 2021)
- Draft Rule 2 WAC 246-976-580 and 246-976-700 (11/22/2022)
- 2019 American College of Surgeons Trauma Systems Consultation Report
- Revised Code of Washington
- 2023-2025 Designated Trauma Service Regional Minimum/Maximum Numbers
- Additional data provided by the Department of Health

This information is supplemented by a review of the history and existing literature related to trauma system design, and temporal changes in trauma system configuration in various regions across the country. Much of this information has been referenced in prior work conducted by and for the Department of Health, and a comprehensive bibliography is beyond the scope of this work. I have previously written a detailed account of the evolution of trauma systems in the US which contains an extensive bibliography(1) and have cited it here along with other selected sources.

I have also utilized extensive expertise and experience gleaned from my work leading the Trauma Systems Consultation program of the American College of Surgeons Committee on Trauma, which has included over 25 site visits and technical consultations in the US and internationally, including the 2019 Washington State visit.

Guiding principles of trauma system design have been taken from various source documents(2-8).

Background Information

The state of Washington has long been a leader in emergency medical systems (EMS) and in the care of the injured. It has a well-organized and high-functioning system for the provision of trauma care that is based on foundational legislation enacted in 1990. Recognizing the heterogenicity of the state, both in terms of geography and population density, the system has a regional infrastructure that allows for local flexibility under its over-arching state regulations. There are eight EMS and Trauma regions, each of which has responsibility for developing and implementing their own plan. Consistent with prior work on trauma system design and the position statement of the American College of Surgeons Committee on Trauma (ACSCOT) (8) the allocation and distribution of resources is to be determined by the needs of the population served.

The statute grants authority to the Department of Health to establish standards for designation of trauma centers at level I, II, III, IV, and V for adults and level I, II, and III for children. In addition, the Department of Health has the authority to determine the minimum and maximum (min/max) number of trauma centers that can be designated at each level, based upon input from the EMS and Trauma regions. The current regulations do not provide a specific framework or criteria to guide the determination of need or the setting of min/max values. As originally configured, the level I center role was defined as a state-wide resource and assigned a maximum value of one. Since inception of the system, the level I designation has been held by Harborview Medical Center, located in the Central region. Min/max values for other levels are set by the state with input from the regions and have remained relatively static over the years. Following an initial period of growth, the number of designated centers has also changed little over the past 10 to 15 years.

Prior to the mid-2000's, in Washington as in the rest of the country, there was little interest among hospitals in seeking new trauma center designation. As a result, there was little controversy regarding min/max values at each level. Large-scale changes in the economics of care in the 1990's and early 2000's changed this dynamic, and the number of hospitals seeking new trauma center designation began to increase rapidly across the country, especially in urban and suburban areas (1). In Washington, this was manifested as an increased interest in the process of setting min/max numbers for each region, and in some cases disagreement about the priorities and the approach that should be used.

In 2019 the state engaged the Trauma Systems Consultation Program of the ACSCOT to conduct an external assessment of the Washington State trauma system including a specific focused request for guidance on a process for determination of min/max values for trauma center designation. The assessment report included recommendations to establish a consistent process to determine min/max values, to conduct a new state-wide needs assessment to inform that process, and to put a moratorium on designation of new trauma centers until this work had been completed. Based upon these recommendations, the Department of Health established a min/max workgroup, composed of trauma experts from across the state, tasked to develop the principles and

rules that would guide such a process. The min/max workgroup met for a period of about 4 months in the spring of 2020 and produced a set of recommendations and general principles to guide determination of the number and location of trauma centers. The workgroup failed to agree on a process or a specific set of criteria to establish min/max values and concluded that it would be necessary for the Department of Health to establish rules to govern the process.

In 2023 the Department of Health engaged in a rule-making process. Following the lead of the min/max workgroup, the rule focused on the establishment of eligibility criteria under which centers could apply for new level I or level II designation and did not address calculation of min/max values. A draft rule was developed, but ultimately there was significant disagreement about elements of the rule that precluded a broad consensus. One group believed the proposed criteria were too restrictive with respect to new center designation and the other considered them too liberal. No compromise could be reached, and the Department of Health did not feel it was practical to establish a rule without such consensus. The proposed rule was withdrawn, and the focus was shifted to the completion of the State Trauma Services Assessment with the goal of providing data and guidance to the EMS and Trauma regions that would enable them to recommend min/max values to the Department. The result is the current draft assessment document, which is the subject of this external review.

Analysis of Prior Work

Min/Max Workgroup Recommendations

The final min/max workgroup recommendation document from June of 2021 stated two goals:

- To provide access to level I or level II trauma center care with 60 minutes of injury for 95% of the population
- To ensure optimal outcomes by maintaining the volume of injured patients in level I and Level II centers that are performing well

The access goal is a reasonable policy statement that is consistent with similar policies established in other trauma systems across the country.

The second goal, related to preservation of volume at level I and level II centers, is also reasonable, but incomplete and insufficiently detailed to provide operational guidance. The goal fails to address the clear operational trade-off between limiting the number of trauma centers to preserve center volume and ensuring a sufficient number of trauma centers to provide system resilience and surge capacity, which was identified as a vulnerability in the 2019 ACSCOT report. In addition, the goal assumes that current trauma center volumes are optimal, without providing supporting data or a rationale for this decision. Finally, the goal does not define objective criteria to determine if a center is “doing well”.

The workgroup report did not actually propose a process or methodology to determine min/max values for various levels of trauma center as tasked, but instead focused on defining criteria under which new applications for level I and level II designation would be assessed. These criteria are specific with respect to an uncontested assessment of need if transport times to existing centers exceed 60 minutes based on geospatial analysis. The criteria are also specific in stating that a new center cannot be within 30 minutes transport time of an existing center. Neither of these criteria are supported by data, but the 60-minute access criterion has been used by many other investigators as a rule of thumb, potentially based on the widely recognized concept of the "golden hour". Other trauma systems have established rules to limit trauma centers based on population served (California) or geographic proximity (Pennsylvania), but these criteria also lack objective data supporting their use.

The remainder of the recommendations from the min/max workgroup focused on maintaining the volume at existing centers, assessing diversion time and quality of outcomes to determine if existing centers are serving the needs of the community, and assessing the fiscal impact of the new center. Besides using specific volume criteria derived from the ACSCOT, no method of analysis or metrics were suggested to enable the assessments to be made.

Additional requirements specific to the subspecialty coverage, research, and educational missions of a level I center were also included, all based on the presumption that the volume at the existing center not be negatively impacted, but without metrics or criteria to determine what an adequate volume at the level I center might be.

Though all the concepts touched upon by the min/max workgroup recommendations are reasonable from a common sense point of view, they lack the specificity and criteria required to be of value in guiding objective decisions. Moreover, taken together, they reflect a strong bias toward the status quo rather than seeking to establish the balance between centralization and system capacity.

This work was subsequently carried over and served as the basis for the rule-making process.

Proposed 2023 Designation Rules

Working from the concepts developed by the min/max workgroup, the Department of Heath began work to revise the rules around trauma center designation, focusing on the eligibility criteria for new applications. The process adopted the specific criteria for access, geographic proximity, and volume of severely injured patients from the min/max workgroup recommendations, and went on to establish that a facility applying for level II status had to have been designated at level III for a full 3-year period with fewer than 400 hours on diversion, and that a facility applying for level I status had to have been designated at level II for a full 3-year period with fewer than 400 hours on diversion.

As written, the rule would have strongly favored the status quo, and would not have addressed the fundamental problem of establishing min/max values for centers in a specific region. This omission risked making the rule irrelevant if the minimum number of centers for the region had already been exceeded. Nevertheless, the draft rule represented a good start toward creating a uniform and defined process to assess new applications for high level designation, working from the Department of Health's statutory authority to do so.

Washington Trauma Services Assessment 2024 Draft

The draft document is well constructed, containing a good balance of background material, a statement of objectives, and clear presentation of the available data. The obvious limitation posed by the lack of data more recent than 2019 speaks for itself, and the lack of data regarding system finances in the draft precludes assessment of this facet.

As a status report on the current system and a projection of future broad trends the document functions well. As a tool to help the EMS and Trauma regions assess need and propose min/max values for trauma centers it falls short. The desire for transparency on a state-wide basis, combined with the state's rules regarding confidentiality in public-facing documents, render it ineffective. The high-level data that are acceptable for public consumption are inadequate to inform specific decisions regarding population need for trauma resources.

Consistent with its intended use as a regional tool, the assessment document also includes a section on regional planning guidance. This section provides thoughtful suggestions and proposes reasonable questions that might be asked but does not provide any guidance regarding a uniform process or specific metrics and criteria that should be used to help assess min/max numbers. The report states that regions may request specific confidential data beyond what is in the public-facing report to help guide their planning process but does not provide any guidance regarding what data might be important, nor does it provide a template to ensure that the data used for planning are consistent across regions. Without a mechanism to ensure uniformity and specificity, the process for establishing min/max numbers will not be moved beyond its current subjective state.

Assessment

The Washington State trauma system is well-established and highly functional, supported by a strong set of enabling statutes that provide the Department of Health with the necessary authority to establish and enforce rules that ensure trauma center designation is based upon the needs of the population served. The system was initially designed, and the number, level, and location of trauma centers largely determined, at a time when the majority of high-level trauma centers across the country were large academic medical centers. At the time, relatively few other hospitals believed it desirable or financially sustainable to seek trauma center designation. In this environment, the determination that the single level I trauma center should be seen as a state-wide resource was both logical and widely accepted, as were the initial regional min/max values for level II centers that acknowledged the leadership of the level I center as well as the reality that few hospitals had the resources and the wiliness to make the investments necessary to achieve and maintain level II designation. System development over the early years focused on capacity building and the designation of a large number of centers at level III, IV and V, with slower establishment of level II centers in areas of need that were geographically isolated and distant from the level I center. The Central region, in which the level I center is located, made the decision not to designate level II centers, setting the min/max values to zero. The regional min/max values, especially related to level I and level II centers, changed very little up to the point the moratorium was put in place in 2019.

With the passage of time and the changing economics of healthcare more hospitals are interested in seeking trauma center designation at level I and level II, consistent with nationwide trends. The existing regional min/max values do not present a barrier to the establishment of new level II centers in under-served areas, but also consistent with national trends, the interest in new high-level designation is focused primarily in urban and suburban regions. In this case, the min/max values functionally bar expansion and have become more contentious. This situation was one of the factors that led to the 2019 ACSCOT consultation and to the specific focused question regarding an objective methodology for calculating the region min/max values based on publicly available data. The methodology presented in the 2019 ACSCOT consultation report either was not considered by the min/max workgroup or was rejected by that group.

The current disagreement is focused around two primary areas; whether the statewide maximum number for level I centers should remain one and whether the maximum number of level II centers in the Central region should remain zero. With respect to increasing the number of level I centers, the standards for level I designation already set a high bar with respect to the research and educational missions, and the number of potential candidates is very small. Proponents for maintaining the status quo have successfully advocated for measures aimed to ensure the volume of patients treated at the current level I center does not decrease, working from the apparent assumption that the current volume is optimal. This also limits the number of potential candidate facilities. With respect to increasing the number of level II centers in the Central region, proponents for the status quo have successfully advocated for a proximity limit (a radius of 30-minute transport time from existing centers) as well as general statements that the volume and financial stability of existing centers will not be adversely affected.

Proponents of the status quo also successfully advocated for a long implementation time, requiring at least one 3-year period of designation at level III prior to application for level II status, and at least one 3-year period of designation at level II prior to application for level I status. The proponents of expansion argue these measures are too restrictive. The inability to find an acceptable middle ground has made progress impossible, and the moratorium on new designations remains in effect.

The desire on the part of both system stakeholders and the Department of Health to craft a process that is completely objective, evidence-based, and data driven is understandable and laudable. It is equally impossible in the current context. Despite many years of work by many investigators, including the ACSCOT, there are currently no validated and widely accepted metrics of need and no accepted standards to inform trauma system design. As a result, the question of the acceptable level of access to trauma care and how to ensure it remains a matter of public policy; fundamentally a political issue that can be informed by data, but not determined by it. (And as the Department of Health has experienced, this does not even consider the inherent challenges in obtaining high-quality data at the granularity needed to provide answers to the most basic questions, such as location of injury, field vital signs, initial and subsequent destination, and treatment enroute, let alone assessment of potential quality endpoints and attribution of outcomes to a specific phase of care)

These challenges are not insurmountable. Washington begins from a point of great advantage compared to many, if not most, regional trauma systems in that the existing statutes clearly provide the Department of Health with the necessary authority to control the trauma center designation process rather than abdicate to market forces and the motivations of healthcare organizations. Though the exercise of this authority will require care and diplomacy, it is at the heart of the Department of Health's role as lead agency for the system. Further, the current system works well, and has been built through a long and consistent process of cooperative effort among a broad and diverse group of stakeholders that has acknowledged the leadership of the Department of Health.

Opportunities for Improvement and Recommendations

- Due to inability to establish a process to determine regional min/max values for trauma center designation, the Department of Health has focused instead on criteria to determine if a specific facility is eligible to apply for a given level of designation. This approach fails to directly address either the issue of potential over-designation or the issue of lack of system capacity and has not proven to be less contentious.
    - **Recommendation**: Re-focus efforts to directly address a process to determine regional min/max values, informed by available data.
    - **Recommendation:** The process should involve the evaluation of the impact of designation of specific candidate centers to help calculate min/max values. This region-specific modelling should include geospatial analysis to estimate the new population covered by designation of the candidate center, the overlap in catchment area with existing trauma centers, and an estimate of the impact in trauma volume at existing centers. Given the difficulty in accurate estimation of trauma volume from population data, volume estimates based on population coverage are likely sufficient. One approach to such an analysis is presented here (9)
    - **Recommendation:** The process should be established in rule as initially suggested by the min/max workgroup
    - **Recommendation**: Establish a process within the Department of Health to mediate disagreements that develop during the course of policy development and implementation, with the charge and authority to reach resolution.
    - **Recommendation**: It should be explicitly stated, and stakeholders should acknowledge that the rules created reflect regional policy decisions regarding access to trauma care based on local resources and best available data, not an external gold standard.

- The 2019 ACSCOT report identified that the regional councils were not sufficiently resourced to effectively discharge their statutory duties. The implementation of a new system for determination of min/max values will potentially increase this burden.
    - **Recommendation:** The Department of Health should provide resources to assist regions with geospatial analysis and modelling required to support min/max determinations at the regional level

- The 2019 ACSCOT report suggested that there was inadequate surge capacity for level I and level II centers. The current system places a heavy reliance on a single high-functioning level I center in the densely populated Central region, that operates near capacity. This limits flexibility to respond to sudden surges in demand and creates significant potential for major disruption should the capacity

of the level I center be acutely limited due to physical plant failure or internal/external disaster. In addition, though the current concerns about potential over-designation primarily involve the Central region, it is likely other regions may face similar issues as the state's population grows. The balance between centralization and maintenance of high center volume and the added surge capacity and system resilience afforded by adding additional centers is a question of policy that should be addressed directly.

  - **Recommendation:** The process for establishing regional min/max values should consider both the potentially negative effects of addition centers as well as the positive effects of system redundancy.
  - **Recommendation:** The goal should be to ensure existing centers maintain adequate volume, not necessarily that they maintain current volume. There are no validated external standards to define adequate volume. The ACSCOT sets minimum volume requirements for level I centers that are already incorporated in the RCW standards for level I centers and used in the 2022 rule making process. The ACSCOT does not have a volume threshold for level II centers. The ACSCOT-based approach should be used to start. Any modification to these starting parameters must be adjusted to balance the potential relationship between higher volume and outcome with the potential relationship between more timely access and outcome.
  - **Recommendation:** The addition of new centers to existing systems has been highly contentious in many other regions, including Boston, Florida, Los Angeles County, and Houston (the Southeast Texas Regional Advisory Council). Generally, these additions have not caused the severe adverse effects that had been predicted. The Department of Health should contact the corresponding agencies in these regions to gain insight that may help assess and predict the effect of addition of new high-level centers to the Washington State system.

- While the min/max workgroup and the subsequent rule-making process identified some areas of agreement, they generally failed to bring forward actionable recommendations to inform the min/max determination process.

  - **Recommendation:** Build upon the work already begun, utilizing the draft rules previously developed as a starting point.
  - **Recommendation:** Keep the current proposal to define uncontested need if the proposed high-level center is more than 60 minutes away from existing high-level centers.
  - **Recommendation:** If there is significant overlap between the service area of the proposed new high-level center and an existing high-level center, the geospatial analysis should be expanded to include use of population data to determine the degree of overlap in population coverage and need defined when the population overlap is below a threshold level or the new population served is above a threshold level. Examples of this type of analysis can be found in the 2019 ACSCOT report and in other published work(9-12). The chosen thresholds can be guided by the

overarching min/max workgroup goal of achieving level I or level II access within 60 minutes for 95% of the population.

- **Recommendation:** Develop process to determine minimum adequate volume for existing high-level centers in a region. Starting with existing ACSCOT level I criteria is reasonable as this is the only published standard and is already established in the Washington regulations. Any modification to starting parameters must balance the potential relationship between higher volume and outcome with the potential relationship between more timely access and outcome.
- **Recommendation:** Establish metrics to define an adequate volume of patients with serious TBI to ensure that there is sufficient experience in the management. There are no external standards to work from, but a volume of at least 5 patients requiring ICU care for neurologic issues per month may be a reasonable starting point. Whatever metric is chosen must be adjusted to balance the potential relationship between higher volume and outcome with the potential relationship between more timely access and outcome.
- **Recommendation:** Define metrics to estimate available capacity at existing centers and candidate centers, consider ED length of stay, time to acceptance of trauma transfers, and hospital occupancy in addition to time on diversion as initial metrics to estimate available capacity.
- **Recommendation:** Define the quality metrics that will be evaluated and threshold for acceptable performance. Use the data provided in periodic TQIP reports, including outcomes and process measures, as a starting point.

- The draft Trauma Services Assessment does not contain sufficiently granular data to inform regional min/max decisions.

  - **Recommendation:** Develop a baseline set of data sufficient to answer the questions posed in the Regional Planning Guidance section of the Trauma Services Assessment, to be considered by all regions in determination of need. An initial set of data points could include:
    - Destination for all trauma EMS runs
    - Transport times for all trauma EMS runs
    - Volume at each trauma center and NTC
    - Injury severity at each trauma center and NTC
    - Potential quality metrics
      - Crude mortality
      - Transfers in/out
      - Number of severe TBI managed locally
      - Timeliness of OR, Fracture fixation
      - Measures of hospital over-capacity
        - ED LOS
        - Hospital occupancy
        - Time to acceptance of transfers in
        - Diversion hours

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Washington Trauma Services Assessment

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THE CURRENT STATE

It is important to state that Washington is one of the states that has existing legislation limiting the ability for hospitals to apply as a new or novel high-level trauma center, and similarly limits hospitals from applying for Level 1 status because there may only be one such center in the state. It is this author's experience that many states do not use legislation to embrace a "needs-based" reasoning for allowing trauma center designation, but rather, allow designation to be based on national verification from the American College of Surgeons or designation from their own state's Department of Health (or equivalent). So, the notion that the state of Washington must "limit" the number of trauma centers is not inviolate. Washington has seven Level 1 and Level 2 centers (combined) for a population of 7.79M residents, or one Level 1 or Level 2 center for every 1.3M residents. Ohio, on the other hand, has 29 Level 1 or Level 2 centers for 11.76M residents, or approximately one Level 1 or Level 2 center for every 400,000 residents. Based on these data and national data, it seems intuitive that Washington would be well-served to have more high-level trauma centers. The intuitive role of the state (to this author) would be to facilitate, encourage, and fund trauma center development in the state, and not to restrict trauma centers from forming or achieving higher-level designation.

While the 2024 draft report is excellent, it does not answer the question "How severe is the problem?" for reasons discussed in the next section. Said more simply, the report contains data showing the portion of injured patients who arrive at a L1 or L2 trauma center within 60

minutes, but it does not have paired data to show which of those patients could or should have had resuscitative or operative care either at a trauma center closer to the injury. In other words, the reader cannot learn whether all of the patients needed the level of trauma center where they received their care. Similarly, the reader cannot learn whether bypassing lower-level trauma centers (or conducting very early transfers to higher level centers) actually harmed patients. As such, the problems related to the status quo are implied but poorly supported by data.

LACK OF EVIDENCE-BASED DETAILED CURRENT DATA

One of the limitations is that the data is from 2019 and is unpaired with outcomes data. As stated on the previous page, it would be ideal (and helpful) to get recent data showing three separate groups with similar injury severity scores. The groups could be 1.) those patients who underwent operative and resuscitative care at a lower-level center and were then sent to a higher-level center; 2.) patients transferred from the scene to a higher-level center who bypassed a lower-level center; and 3.) patients treated briefly at a lower-level center and then rapidly transferred to a higher-level center for emergency operative care. Perhaps the NFTI tool (need for trauma intervention) tool could be used to help stratify and understand these groups. If volumes were high enough to reach statistical significance, these patients could be compared with outcomes to understand whether these initial triage decisions were helpful or harmful.

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Similarly, the use of TQIP data (Trauma Quality Improvement Program, from the American College of Surgeons) could stratify these hospitals as it pertains to blunt vs penetrating trauma, time to transfer, where the definitive care occurred, and outcomes. It is unknown to this author whether trauma centers in Washington participate in TQIP. This is discussed in the "Next Steps" section.

LEVEL III-N TRAUMA CENTERS?

With implied apologies for its naivety, this author must ask about the statewide supply of neurosurgeons willing to participate in trauma call. In this context, the question as to whether Level III-N centers (a verification level offered by ACS for Level 3 centers with neurosurgical capability) should be considered in Washington. Though comparatively new, this verification level has allowed hospitals to indicate to the EMS and the referring community the extent to which moderate-to-severe closed head injury may be cared for locally. If this designation level were offered by the State of Washington, would more neurosurgeons (who may be on the hospital staff for elective spine surgery) opt to participate in neuro trauma call? Or, is the problem a state-wide shortage of neurosurgeons willing to provide trauma call?

Candidly, this author cannot help but wonder whether state trauma funds could be used to incentivize neurosurgeons to provide care at Level 2 and Level 3-N centers. We similarly do not know the reasons for most of the transfers. The phrase, "closest appropriate trauma

center" comes to mind. But, at what outcome cost do we make these long transfers? And to what extent would lower-level trauma centers have a valid argument that some of the vast funding afforded to the one-and-only Level 1 center be better spent providing specialty services (specifically neurosurgery) at hospitals geographically distributed around the state? An arterial epidural hemorrhage comes to mind as an example of pathology that simply sometimes cannot wait to arrive at a center capable of caring for this problem, particularly in Washington.

WHAT CRITERIA ARE USED BY TRIAGE DECISION-MAKERS?

The draft report contains verbiage about "Integration of E-911 centers". This is an intriguing concept, but it raises questions about the current process. Who typically makes the decision to transfer a patient, or to bypass a lower-level trauma center. There should be standardization of this process with state (not local) guidelines, and these guidelines should be based on the availability of services, and not necessarily the level of trauma center designation.

Specifically, with the exception of research and some elements of regional responsibilities, Level 1 and Level 2 centers are near-therapeutic equivalents. Certainly, replantation is not commonly available in Level 2 centers, but definitive care for life-threatening injuries is available in Level 2 centers. To this author, the "low hanging fruit" are those patients who either were transferred from a Level 2 center to a Level 1 center, or who bypassed a Level 2 center en route to the Level 1 center. It seems that the priority should be to understand

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these patients first. In other words, if someone could not be treated at a Level 2 center, then why not? Similarly, among those patients who either left or avoided a Level 3 center, how many (and which) patients could have had damage-control procedures at the local center? Integration of the E-911 centers into an empowered algorithm for distribution to definitive care seems like a viable and valuable option.

EMPOWERMENT OF REGIONAL TRAUMA ADVISORY COMMITTEES

This author has no definitive information as to the extent to which Regional Trauma Advisory Committees (RTACs) in Washington are empowered to oversee triage decisions and decisions on transfers. There is a national tendency for RTACs to stay away from litigious situations. Still, if this "oversight" of these decisions is done retrospectively and with an educational (non-punitive) focus, it may be better accepted. Perhaps these RTACs could be required to submit these data to the Department of Health to ensure that the State Trauma Medical Director or the State EMS Medical Director (suggested by the ACS report) are able to interact with physicians who chose to conduct avoidable or unnecessary transfers. Perhaps legislation could be enacted that would empower the RTACs to publish data on the appropriateness of transfers, and include this information at the time of state re-designation visits. Regardless of the method, it is not intuitive to believe that the sending physician should have no accountability for his or her decisions, especially when we know that some patients are not receiving timely care when they bypass or are transferred from institutions capable of providing that care.

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WHY ONLY ONE LEVEL 1 TRAUMA CENTER BY STATUTE?

This author lacks the extensive history of legislation and negotiating the distribution and level of trauma centers in Washington. Still, it is counter-intuitive to suggest that a state as geographically vast as Washington should have only one Level 1 Trauma Center. If this limitation concentrates the distribution of a larger (or majority) sum of the trauma funds, thereby reducing or eliminating funding for other centers (see comments regarding neurosurgery on page 5), consideration should be given to changing this legislation. While it could be stated that there is not a need for an additional trauma center to conduct research (the largest difference between a Level 1 and a Level 2 center), funding geographically diverse Level 3 centers to add services (including neurosurgery) seems more likely to positively impact patient outcomes. Perhaps the most significant issue is not how many Level 1 centers exist, but rather, how many lower-level centers in diverse regions could be funded to hire neurosurgeons, incentivize keeping care local, and improve outcomes by eliminating unnecessary transfers.

THE MIN/MAX CRITERIA

Perhaps we are studying the wrong issue. Rather than conducting further work to determine which hospitals can apply for higher level trauma designation from the state, we should study the distribution of funds to various hospitals (trauma centers and non-trauma centers). Again, it is not intuitive to suggest that a hospital should create a research department with the near-sole purpose of becoming a Level 1 trauma center (to achieve greater funding). Instead, this author proposes that a better approach is to identify the gap

in funding for centers throughout the state and change the funding patterns such that funding is based on need, not trauma center level. For example, if a center is geographically remote and has a reasonable volume of outbound transfers, a greater amount of funding may be required to incentivize retaining more complex cases. In fact, this funding requirement may be greater than the difference between existing funding for a Level 1 center (as opposed to a Level 2 center). Disassociating the funding from trauma center designation level may allow the state funds to impact outcomes more favorably. Said somewhat differently, funding amounts should be based on need, and often, lower-level centers have greater needs than the highest-level mature, existing centers.

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RECOMMENDATIONS:

1. Obtain funding for a State Trauma Medical Director and State EMS Medical Director as suggested by the American College of Surgeons. Partial justification for this appears on page 6 ("empowerment of RTACs").
2. Empower the RTACs to conduct a retrospective analysis of the appropriateness of triage decisions (to include bypass of existing centers or transfers to a higher level of care). Use these analyses (along with the authority of the State Trauma/EMS medical directors) as criteria for successful re-designation as a trauma center from the State of Washington.
3. Get new and effective data that includes these triage decisions and paired outcome analysis. Only in this manner can we quantify the effect of these triage decisions on patient safety.
4. Consider inclusion of Washington trauma centers in the Trauma Quality Improvement Program from the American College of Surgeons. This will provide an effective outcome analysis for groups thought to be appropriately triaged and groups thought to be inappropriately triaged.
5. Consider the NFTI (Need for Trauma Intervention) tool to retrospectively evaluate transfer triage decisions. This is probably superior to the Cribari method for pre-transfer patients because the Injury Severity Score (mandatory for Cribari analysis) is often not known by the individual making these immediate triage decisions.
6. Consider implementing the Level III-N designation level to allow hospitals who lack some subspecialty continuous coverage to provide neurotrauma care.

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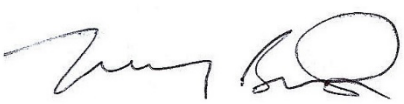
7. Integrate E-911 centers such that a central repository of data exists for triage or transfer decisions. Further, this will allow a single "set of rules" to be used state-wide as they pertain to these decisions.
8. Consider prioritizing funding for lower-level centers in geographically remote regions to allow additional staff (e.g. neurosurgeons) to be hired. This may eliminate the need for otherwise unnecessary transfers. Perhaps these needs should be prioritized over "Level of Trauma Center Designation" for distribution of state trauma funds.

Respectfully submitted,



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Washington Trauma Services Assessment Review

Report Completed By:

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Final Version: July 12, 2024

Introduction

The Department of Health (DOH) under the auspices of the State of Washington has requested review and input on two important trauma system development documents. The documents are the draft "Trauma Systems Assessment Report 2024" and the 2021 Min/Max Workgroup recommendations. These documents reflect an impressive dedication and commitment of the DOH and trauma leaders throughout the State in supporting the continuing evaluation and development of the trauma system to provide optimal care to the injured patient.

Methodology of Assessment and Review Analysis

The overall methodology of assessment for this project consisted of a review of the WA Trauma Services Assessment 2024 document, including references listed within this document and, the most recent, and best available data. Three focus group discussions were held with DOH leaders and trauma staff, and the 3 retained trauma consultants. The Trauma System Consultation Report from the American College of Surgeons Committee on Trauma, 2019 provided comprehensive information on background, current status (as of 2019), and recommendations. Additional documents reviewed were the draft Trauma Designation Rules (WAC 246-976-580 Trauma Designation Process); the concise explanatory statement and summary of public comments, Rules for WAC 246-976-580; the rescinded Rules; Trauma Care Fund Disbursements per Year; data tables depicting transfer patterns; and multiple informational e-communications.

Evaluation of Current Resources

The State of Washington has sustained a trauma system since 1990 through formal legislation. The DOH is the lead agency. The EMS and Trauma Care Steering Committee acts as an advisory committee to the DOH. Currently, there are 84 designated trauma centers within the State of Washington. There are 8 EMS Trauma Regions, and each Region has a Council. The Trauma Care Council's responsibilities include regional system development.

During the 2019 ACS Trauma System Consultation, the DOH requested the survey team provide recommendations focusing on calculating min/max estimates from U.S. experiences. This is outlined in the ACS System Survey report, Appendix F. These recommendations are still relevant and should be considered as a key point of reference for consensus building toward an approved WA State min/max criterion. Using this report as a building block, with the WA State Trauma Assessment document, the State and regions have sufficient information to make informed decisions on numbers and levels of trauma centers. However, it is imperative to ensure performance improvement (PI) metrics are added to this process as soon as possible. For example, the most current data is showing a high number of transfers for higher level of care. But, to adequately evaluate care and the need for additional and / or higher levels of trauma centers, PI metrics data is needed including specific reasons for transfer, time frames, reasons for delays in transfers, reasons for delays in accepting transfers, reasons for bypassing Level II facilities, and outcomes data. Data elements to support these PI metrics should be part of the

state and facility trauma registries. Routine and timely review at the regional and state level and will augment evaluation and reevaluation of existing Levels and future upgrading of facility levels.

Data in the WA Trauma Services Assessment 2024 is predicting a 30% increase in the population of older adults (65 and older) between 2020 and 2030. From 2015 to 2019, the geriatric trauma patient volume has increased 49%. This information shines a light on the need to prioritize geriatric trauma initiatives at the state, regional, and facility level. Specifically, regions may consider geriatric protocols to optimize care at each level trauma facility and appropriate transfers to higher levels of care. In addition, regions may consider adding PI metrics to evaluate geriatric trauma care at both the facility level and regional system level.

Data in the WA Trauma Services Assessment 2024 shows an increase in trauma volume in each of the regions, with the North, East, West, and Central regions experiencing the most rapid growth in trauma volume. The WA Trauma Services Assessment shows "patient transfers out of the EMS and Trauma Region and most frequent among level V facilities while most patients transferred in for care from another region are going to the Level I center." This infers the trauma system is working as it should. Additional information to consider as part of the Min/Max process is to review how many of these patients are bypassing Level II facilities, and how many have double transfers. For those bypassing Level II facilities, PI metrics are needed to understand what resources these level II facilities do not have, and why. Further, if these Level II facilities are not meeting the trauma system regulatory requirements for their level of clinical care, then they should be guided and supported in completing corrective actions. Further breakdown of this cohort of patients may include specific PI metrics such as the reason(s) for not transferring to a Level II facility, resource availability or lack thereof, distance, transport times, etc.

The WA Trauma Services Assessment 2024 Report includes data on prehospital provider drive time to a trauma center in 30-, 45- and 60-minute intervals. This is valuable information that will help inform decision making on leveling of trauma centers and need. This shines a light on the potential need for additional and consistently optimal functioning Level II centers, or possibly releveling a Level II to a Level I. Figure 27 and 28 in the WA Trauma Services Assessment 2024 Report provides valuable information to help focus decision making regarding the need for higher levels of care in specific regions balanced with the challenges of taking EMS providers out of service for lengthy transports and pulling patients away from families.

The "Final Min/Max Workgroup Recommendations, June 8, 2021" (are highlighted in green and gray) and are followed by the reviewer's comments, and recommendations.

	Goals
	1. To provide access to Level I or II trauma care for 95% of the population in WA state within 60 minutes of injury 2. To ensure optimal patient outcomes by maintaining the volume of injured patients in the current Level I and II centers that are performing well.

- Based on the most recent data available, goal number 1 seems reasonable.

	Process
1	**Conduct a geospatial analysis of access to definitive care for Washingtonians to determine the proportion of the population who can reach definitive care at a Level I or II trauma center within 60 minutes of injury. This analysis should factor in available transport options (air or ground) to identify geographic gaps in access to care.**

- This process has been completed.
- When more current system trauma registry data becomes available, updating the data tables will be helpful.

2	**Develop strategies to actively support hospitals in areas with a geographic need to overcome barriers in achieving Level II status.**

- The reviewer agrees with this process.

3	**Process to assess new Level II applications**

- The reviewer agrees with this process but suggests that additional details may be necessary if more than one facility in a region desires to change (upgrade) their status. For example, if two Level III facilities are interested in upgrading to a Level II status, then a formal request for proposal (RFP) process may be necessary. This may include on-site consultative/designation surveys from neutral trauma site surveyors. A significant focus during the on-site surveys should be on data driven PI processes to assure standards of

trauma care are met. In addition, there needs to be ample evidence the requesting facilities can sustain the Level II requirements.

b.	If a proposed site for a new trauma center is already served by an existing Level I or II then a review must be conducted to demonstrate the need for an additional center. The new center shall not have a negative impact to the existing centers that are performing well, or the trauma system as a whole. The DOH should be notified one year in advance of the proposed application to allow sufficient time for analysis. The following factors should be evaluated by an advisory group of clinical and epidemiological experts appointed by the Secretary of Health: i. The new center should be at least 30 minutes transport time from the existing center by available transport methods. ii. Addition of the new center should not allow the volume of the existing center to fall below 240 patients with an ISS >= 16 (ACS criteria) iii. The quality of outcomes and time on divert should be evaluated for the existing center to ensure they are meeting the needs of the community. iv. An analysis should be done on the fiscal impact to the existing centers from addition of a new center based on both projected changes in the patient distribution and the distribution of the Trauma Fund v. Based on review of this data, the advisory group will make a recommendation to the DOH who will make the final decision.

- Section "b": "the DOH should be notified 1 year in advance… to allow sufficient time for analysis" should be clarified to include language pertaining to an on-site consultative / designation survey. Additionally, a time frame for verifiable trauma registry data and trauma performance improvement activity should be available for review.
- Section "i": 30-minute transport time seems inconsistent with Goal 1 "providing access to Level I or II trauma care… within 60 minutes of injury".
- Section "ii": should be revised to apply to the impact on Level I facilities only. Amend these criteria to be consistent with the ACS language, e.g., 1200 inpatient admissions or 240 patients with an ISS > 16. This volume criteria do not apply to the Level II facilities.
- Section "iii: Evaluating outcomes requires robust data driven PI metrics. This must be outlined for clarity and adherence. "Quality of outcomes" is distinct from "time on diversion." Time on diversion must have specific metrics and thresholds set for trauma. Time on trauma diversion should be zero or only happen during extraordinary circumstances such as internal disaster. Trauma diversion must be separate from ED diversion. Bed availability should not be an allowable criterion for trauma diversion. Bed contingency plans should be in place at Level I and II facilities.
- Section "iv": The hospital applying for a change in Level should provide a financial analysis on the fiscal impact on their own facility and written commitment to ensure all trauma hospital criteria are met and sustainable.

4.	**New Level I applications:** **New applications for Level I centers should meet all of the criteria for Level II center applications as noted above. Additionally, the following requirements apply:**
a.	The primary difference between a Level I and II for clinical care is access to subspecialty services for unique, complex injuries which require less urgent transportation of patients needing these services after stabilization at a Level II. Therefore, there must be a need to expand subspecialty trauma care and sufficient volume to ensure quality of subspecialty care at existing Level I centers is not affected. Barriers to access for subspecialty care at the existing Level I centers should be assessed. An evaluation of the impact of the new center on the case volume for subspecialty care at the Level I based on current and projected referral patterns is needed.

- The reviewer suggests that specific language pertaining to subspecialty care be added for the Level II facilities. Outlining the specific subspecialty care required for Level II facilities will help with the application (RFP) process in determining need, assist in evaluation of appropriate transfers for higher level of care, compliance with standards of care, and trauma Level requirements. By requiring specific PI metrics, system stakeholders, DOH and site survey teams can appropriately evaluate why patients are being transferred out. It is imperative during the process of upgrading from a Level II to a I that careful evaluation of resources and the institutional commitment is solid.

b.	Level I centers are also charged with supporting training programs for trauma care which include ACGME accredited residency programs and fellowship programs in subspecialty care. At a minimum, a Level I trauma center must have continuous rotations in trauma surgery for senior residents that are part of an Accreditation Council for Graduate Medical Education accredited program. In addition, the new Level I should not negatively impact case volumes that support subspecialty fellowship programs at the existing Level I.

- The reviewer agrees with these criteria.

c.	The Level I applicant must support comprehensive research programs to advance trauma care. Impact on enrollment and participation in clinical trials at the existing Level I centers should be considered, as well as the potential impact on existing research and education programs based on projected changes in subspecialty case volume.

- The reviewer suggests adding specific criteria to this section. For example, the type, and volume of research required, and that all research must originate from the facility applying for Level I status. The reviewer suggests deleting the second sentence; there may be minimal or no impact on an existing Level I center. Alternatively, the Level I facilities should work collaboratively with

the other trauma facilities, including the Level II's to include them in research activities. This aligns well with the philosophy of having Level II facilities being an important part of a trauma system with minimal differences in clinical capabilities.

d.	Centers proposing to apply for Level I status should notify the DOH one year in advance to allow time for analysis. The following factors will be evaluated by an advisory group of clinical and epidemiological experts appointed by the Secretary of Health.

- The reviewer suggests adding details to clarify this process. Specifically, the time frame for data driven PI; the survey data period; the process for site survey, e.g., on site survey by neutral consultants followed by a final decision from the DOH; probationary period while the facility compiles data, PI, and research requirements (or must the facility meet the Level I criteria before designation occurs)?

e.	Ensure the center applying meets the criteria as outlined above.

- The reviewer agrees with this metric with the above-mentioned suggestions.

f.	The quality of outcomes and time on divert should be evaluated for the existing center(s) to ensure they are meeting the needs of the community

- The reviewer agrees with this requirement but recommends the addition of specific metrics, e.g., reasons for trauma diversion. Consider developing metrics for reporting, for the Level I and II facilities for trauma diversion and include this as part of the mandatory designation criteria. Specifically, as Level I and II facilities, they should not be on trauma diversion status more that XXX number of hours per month. This metric should be evaluated monthly, annually and at the time of designation. Diversion status should be routinely reported to DOH on a monthly basis to ensure community needs are being met. Upon review of the draft Rule changes, it is noted that allowable diversion hours were 400 hours in the 3-year designation period. This is excessive and will not appropriately serve the community.

g.	Based on review of this data and the fiscal impact and solvency to existing hospitals, the advisory group will make a recommendation to the DOH who will make the final decision.

- The reviewer agrees with this requirement, but additional details will be helpful. Specifically, a detailed process for time frames for data, PI, and research; review processes to ensure trauma hospital criteria are met, and specific details on the site survey process such as an outside neutral review team who completes the survey and provides recommendations to the DOH.

Gaps and Inefficiencies

The gaps and inefficiencies include but are not limited to an outdated non-functioning (and non-compliant) trauma system software and trauma system registry. There is also an apparent lack of trauma performance improvement (PI) activity and metrics. There appears to be delays and barriers in correcting the trauma registry software issues. These issues have hampered both the DOH, and the Regional Trauma Care Councils from using timely data to inform decision making. There are minimal PI metrics in place at the regional or state level pertaining to transfers. To help improve and support the Min/Max process, and to continuously evaluate patient flow, transfer patterns, outcomes, resource availability, facility compliance with their level of clinical services requirements, and standards of patient care, timely PI metric reviews are necessary. Timely and formal PI review of metrics will significantly augment trauma system and trauma facility adherence to optimal standards of trauma care, as well as the Min/Max process.

Recommendations for Addressing Identified Issues, Gaps, and Resources Needed

- The WA Trauma Services Assessment 2024 (draft) is an excellent document and will be invaluable in focusing stakeholders on trauma initiatives including finalizing the Min/Max criteria.

- To avoid further delays in completing the Min/Max recommendations, the WA Trauma Services Assessment 2024 should be used as a roadmap to guide and support the work of the Regional Trauma Care Councils. This includes the evaluation and planning for increasing trauma center levels for existing facilities.

- Counties and regions with population growth and rapid increase in trauma volume should be a priority focus for evaluation of trauma facility resources. Additionally, Level II facilities that are being bypassed during the transfer process should be high priority for assessing compliance, resource availability, and PI metrics.

- Formalize the process for reviewing transfers to higher level of care. Data for the PI metrics should be included in the facility trauma registry and uploaded to the trauma system registry.

- Consider resetting the trauma diversion requirements for the Level I and II facilities. Due to the challenges the Level III, IV, and V centers have with geography and prolonged transfer out times,

allowing the Level I and II facilities to go on trauma diversion is a disservice to the injured patients within the trauma system.

- Timely monitoring and PI case reviews should occur for delays in transfers of patients to higher level of care at Level I and Level II facilities. Delays in higher level of care should not be related to bed availability or ED diversion. Zero trauma diversion hours should be the norm for Level I and II facilities. Strengthening this in the form of a system policy may be necessary for the good of the trauma patient.

- All Regions should adhere to the same designation process including the same criteria for Level I through V centers. There should not be a lower standard for facility designation for any specific region.

- Designation criteria should be based on the most current version of the "Resources for Optimal Care of the Injured Patient" from the Committee on Trauma, American College of Surgeons.

- Consider reevaluating the trauma funding formula and work with key stakeholders to adjust as needed based on the WA Trauma Services Assessment 2024 and other pertinent information sources. Funding should be made available to support necessary resources at trauma facilities where the transfer and outcomes data shows the need for additional resources. Although this would likely be a lengthy and complex project, ultimately, it could allow funding to be allocated where it is most needed.

- The DOH, Trauma Care Steering Committee, and the Regional Councils should consider collaborating with the Secretary of Health and local legislators to secure financial support to fulfill appropriate level trauma center capabilities for the communities they serve. For example, if the Regions, and the DOH have PI data to show poor outcomes related to transfers out, delays, and unavailability of specialty care, then efforts to support facilities in attaining Level II or Level I status should be a regional and State priority.

- Consider working with all trauma system stakeholders to adopt a widespread trauma system philosophy that Level II centers are almost identical (clinically) to a level I and outline these differences. The Level I facility and potential new Level I facilities are invaluable. The caveat is that the Level II facilities need to be continuously performing at Level II standards.

- Timely monitoring and review of transfers should be routinely assessed. Specifically, it will be helpful to identify transfer patterns such as those patients arriving at Level III, IV, and V facilities that are then bypassing a Level II facility to reach the Level I. Detailed metrics for data collection and reporting should be mandatory given the unique characteristics of the trauma system. Metrics include the reason(s) for bypassing a Level II facility. These metrics should be embedded in mandatory facility trauma registry data collection and reporting processes. There should be clear definitions for data and PI metrics. Timely review at the Regions should occur. All data and PI reviews and findings should be reported to the DOH trauma system registry for inclusion in

ongoing assessments related to care, adherence to trauma center criteria, and Min/Max assessments.

- Recommend reviewing the Regional EMS and Trauma Care Councils most recent plans. The Councils are required to submit a biennial regional plan that includes identifying the minimum and maximum number of trauma designated facilities at each designation level. It may be beneficial to review the previously submitted plans to gain knowledge and understanding and provide direction on the current Min/Max process.

- Correct the issues with the trauma system registry, software, and vendor. Timely data is imperative to support appropriate decision making. In lieu of current data, use the best, most recent, and available data sources. (This is reflected in the current version of the WA Trauma Services Assessment 2024 document).

- Consider prioritizing geriatric trauma initiatives at the state and regional level. Specifically, the Councils should consider implementing geriatric trauma protocols to optimize care at each level trauma facility guidelines for appropriate transfers to higher levels of care. In addition, consider adding PI metrics to evaluate geriatric trauma care at both the facility and regional levels.

- Consider meeting with other State and County EMS-trauma system agency leaders to gather information on their experiences with Min/Max criteria and processes; their experiences in designating new facilities; de-designating facilities; upgrading the status of existing facilities; and the impact on existing facilities when new/adjacent facilities are designated. The reviewer suggests meeting with leaders form Los Angeles County EMS Agency. Although The WA and LA trauma systems are different, an information exchange may support the DOH process.

- Ensure equity is embedded into the final version of the assessment document and remains high priority.