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AMERICAN COLLEGE OF SURGEONS COMMITTEE ON TRAUMA
Trauma Systems Evaluation and Planning Committee

Trauma System Consultation Report

State of Washington

Tumwater, WA

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AMERICAN COLLEGE OF SURGEONS
Inspiring Quality: Highest Standards, Better Outcomes

An interdisciplinary panel of nationally recognized experts prepared this document, based upon the American College of Surgeons (ACS) Trauma System Consultation (TSC) site visit to the State of Washington, which took place April 22 – 26, 2019. Panel members included the following:

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EXECUTIVE SUMMARY

The State of Washington is one of the wealthiest and more socially progressive areas of the country and has consistently possessed one of the lowest unemployment rates and highest life expectancy ratios. It is also one of the most geographically and topographically diverse areas, with rich yields of natural resources that form a significant part of its gross domestic product. The state covers approximately 71,362 square miles of the northwestern United States, and boasted a population of more than 7.5 million in 2018, with steady projections of future growth. The major urban and metropolitan areas encompass a relatively small geographic portion of Washington State which includes nearly 60% of its residents. The larger, rural area of the state incorporates the remaining population, who are largely located in isolated and tightly-knit local community groups.

In 1990, the Washington State Legislature granted the legal authority for the establishment of a statewide EMS and Trauma Care System, through a similarly named Act of the Revised Code of Washington (RCW) Title 70, Section 168. The Legislature, through this Act, authorized the State Department of Health (DOH) to adopt and promulgate rules for governance of the Washington EMS and Trauma Care System, thereby establishing the DOH as the lead agency with the responsibility to provide oversight and leadership to the System (RCW 70.168.050). Of the many divisions within the DOH, its Health Systems Quality Assurance Division houses the Emergency Care System that fulfills the tasks of ensuring program development and providing operations management, as the designated arm of the DOH for carrying out lead agency responsibilities. The Legislature also ensured that the DOH was granted authority to enact rules for the establishment of a grant program for designated trauma care services (RCW 70.168.135). In addition, the Legislature further established a statewide EMS and Trauma Care Steering Committee (RCW 70.168.020), defined its membership, and designated its responsibilities, which include advising the lead agency on emergency medical services and trauma care needs throughout the state. Along the same lines, the Legislature established local and regional Emergency Medical Services and Trauma Care Councils with the responsibility for local and regional system development (RCW 70.168.120). With supporting legislation granting the lead agency due authority to conduct system development and quality assurance activities, the DOH Emergency Care System is optimally positioned to implement its strategic objectives, regulate statewide performance, and provide leadership to its constituents. Additionally, the lead agency has access to a substantial number of engaged experienced care providers and strategic stakeholders upon which to draw to further develop and refine the Emergency Care System.

The operational dynamic of stakeholder engagement, strong legislative support, and funding have supported the development of a very solid EMS and trauma system for the State of Washington. Over the last two decades, strong trauma leadership and trauma system innovation within the state have fostered a model considered as trauma system best practice. Many of the facets of the Washington trauma system have been emulated by developing trauma systems across the nation. But as all systems evolve, there are opportunities for improvement. As evidenced by the insight to seek an external consultation to further EMS and trauma system evolution in the State of Washington, the system is now uniquely positioned at a crossroads for revolutionary change.

Assets and Advantages

Injury Epidemiology

- The lead agency has dedicated epidemiologists, who are all assets to the Emergency Care system.
- The lead agency has used data to support some research and quality initiatives within the system.
- The trauma epidemiologist has engaged in regular outreach activities across the regions.

Indicators as a Tool for System Assessment

- The trauma program is planning to engage in risk-adjusted system benchmarking efforts.

Statutory Authority

- The State of Washington EMS and Trauma related statutes are well-written, forward thinking, and provide sufficient authority to the lead agency to regulate the trauma system.
- The EMS and Trauma Trust Fund has been established in statute.

System Leadership

- There is significant engagement of leadership within the State of Washington.
- There are invested trauma surgeons, emergency medicine physicians, and EMS leaders working to drive trauma system development.

Coalition Building and Community Support

- Some regions have succeeded in building coalitions with local hospitals for injury and violence prevention activities.

Lead Agency and Human Resources within the Lead Agency

- The lead agency has dedicated staff providing expertise and commitment toward the mission of the Emergency Care System.

Trauma System Plan

- Trauma system stakeholders have been able to employ creative methods to access and utilize available resources to meet their local and regional needs.

System Integration

- Each of the eight EMS and Trauma Regions have integrated EMS and trauma care plans.
- Alternative EMS resources are integrated into the regions, including law enforcement and industry.

Financing

- An EMS and Trauma Care Trust Fund exists.
- The Cost Reimbursement Technical Advisory Committee (TAC) assists the lead agency in developing the distribution methodology plan.

Prevention and Outreach

- Strong injury prevention legislation has supported specific projects and activities within the EMS and trauma system.
- The Injury and Violence Prevention Guide exists and is available online through the DOH website.

Emergency Medical Services

- Long-time, seasoned EMS medical directors are actively engaged within the EMS and trauma system.
- Private aeromedical transport agencies are available to meet the System's needs.

Definitive Care Facilities

- The lead agency has sufficient authority to control the number and level of trauma centers by region.
- The lead agency has established a robust trauma center designation process, which includes an external review using national standards.
- There has been strong leadership from the Level I trauma center.
- High functioning Level II trauma centers exist within the system.

System Coordination and Patient Flow

- A strong state template for triage and destination protocols exists.
- There are well-established and uniform statewide guidelines for field triage of injured patients that conform to national standards.

Rehabilitation

- Rehabilitation beds are available for unfunded or charity care patients within the System.
- The ability to link trauma registry data to rehabilitation data exists within the System.

Disaster Preparedness

- Lessons learned, as well as in-depth After Action Reports, have been developed following mass casualty incidents (MCIs).
- Consolidation of the disaster preparedness and response Healthcare Coalitions (HCC) is largely viewed as beneficial by trauma system stakeholders.

System-wide Evaluation and Quality Assurance

- Statute provides peer review protection for systems peer review activities.

- The State Trauma Program Manager provides education on performance improvement to new local and regional Trauma Program Managers.
- Data is available to conduct system performance improvement.

Trauma Management Information Systems

- The lead agency has a dedicated approach to conducting basic data quality assurance.
- Lead agency staff have frequent interaction with hospitals, including providing educational opportunities and offering data support.

Research

- Research performed on state obtained data drives changes in the processes of care.
- The System has expertise within its network of invested stakeholders to engage in research activities.

Challenges and Vulnerabilities

Injury Epidemiology

- There has been an inconsistent ability to integrate data sources.
- The Trauma Epidemiologist has been stretched thin due to the breadth of responsibility and volume of data requirements at times.
- There has been no routine reporting of data or analysis.
- There is a reactive approach to data analysis, with it often being conducted on a case-by-case basis, rather than looking at the issues across the System.
- Data has not been consistently used to drive strategic initiatives.

Indicators as a Tool for System Assessment

- There has not been a process for periodic evaluation of the System using any standard indicators or benchmarks for assessment.

Statutory Authority and Administrative Rules

- The lead agency has not been utilizing the State of Washington EMS and Trauma related statutes, as written, to their full capacity for System development.
- The State of Washington EMS and Trauma system has not recently conducted a comprehensive review and update of related statutes.

System Leadership

- There has been a lack of system-level oversight to drive growth.
- There is no state-level designated Medical Director for EMS or Trauma.
- Limited resources available at the regional level has resulted in functional limitations.

Coalition Building and Community Support

- The lead agency has not developed sustainable relationships with system constituents, such as health insurers and payers, consumers, policy makers, and the media.
- Under-resourcing of regional offices by the lead agency limits functioning and coalition building.
- The lead agency is not actively engaging strategic partners, such as community groups, local industry, local/regional media, and advocacy.

Lead Agency and Human Resources within the Lead Agency

- There has been insufficient funding to support the lead agency.
- The lead agency has delegated too much authority to its regions.
- The lead agency has not maintained a comprehensive, state trauma-specific plan.

Trauma System Plan

- The state EMS and trauma system plan is not comprehensive and lacks specificity.

- While the Technical Advisory Committee work plans are functional, they are not integrated into a comprehensive state plan and are not readily accessible to stakeholders for action.

System Integration

- There is significant diversion across trauma centers due to lack of bed availability.
- Public Safety Answering Points (PSAPs), or the Enhanced 911 Centers, are not well-integrated within the System.
- There is a lack of consistency in engaging strategic partners, such as EMS agencies, and the level of engagement has been variable across the regions.

Financing

- The lead agency is underfunded and understaffed to meet system expectations.
- The Regional EMS and Trauma Care Councils are underfunded, under-resourced, and understaffed to meet system expectations.
- The funding amount has remained unchanged for the EMS and Trauma Care Trust Fund since it was established in 1997, while the State of Washington population has nearly doubled.

Prevention and Outreach

- The lead agency has limited capacity for exercising a leadership role in the facilitation of injury prevention efforts at the state, regional, and local levels.
- There is a lack of lead agency oversight for injury prevention efforts at the regional levels.
- With only a 0.5 full-time equivalent Injury Prevention Coordinator dedicated to support statewide oversight, the lead agency does not have sufficient resources to lead injury prevention efforts within the System.
- The existing injury prevention initiatives are not sufficiently informed by data.
- The Injury and Violence Prevention Guide is not widely utilized by stakeholders to drive initiatives forward.

Emergency Medical Services

- Although funding is noted to be allocated, there does not appear to be consistent financial support provided for EMS.
- The minimum and maximum number of EMS services is politicized, and the lack of objectivity is not conducive to meeting population needs.
- The number of Medical Program Directors (MPDs) is not sufficient to meet supervisory needs within regions and across the state.
    - MPD vacancies in rural counties have been particularly challenging.
- Critical care ground transport is variable and insufficient to meet population needs.
- Aeromedical destination for scene response is regulated by local responding EMS personnel instead of state designated triage and destination protocols.

Definitive Care Facilities

- There is no uniform objective process for making decisions related to the minimum and maximum number of trauma centers and EMS services across the state.

- The regional infrastructure, aside from the Central Region, is not robust enough to consistently support data driven minimum/maximum assessments.
- The Trauma System is not truly inclusive, as not all hospitals within the state are integrated into the System.
- Level I and II surge capacities are a liability for the System.

System Coordination and Patient Flow

- There is significant pressure to keep patients within healthcare systems.
- In the more isolated and rural areas of the System, complex situations are left to individual providers due to lack of resources.
- There are limited EMS resources for long patient transports.
- The existing hospital bed capacity within the state limits and inhibits the flow of patients through the System.

Rehabilitation

- There is a lack of knowledge regarding specialized care resources available for rehabilitation patients among the System stakeholders.
- There is no formal method of communicating rehabilitation resources to the larger stakeholder community.

Disaster Preparedness

- There appear to be challenges in operational control and usage of the incident command system.

System-wide Evaluation and Quality Assurance

- There is no established effective statewide Performance Improvement (PI) Program.
- There is an inadequate number of dedicated staff at the state and regional level to support the state PI process.
- The PI process is incomplete, with no loop closure.
- No state-level PI tool or toolkits are available to facilitate the PI process.

Trauma Management Information Systems

- The ability to access and link EMS data to trauma registry data is highly variable.
- The lead agency is not using data to engage in systematic performance improvement or system advancement.

Themes

The themes presented below were noted as recurring aspects within the State of Washington EMS and Trauma System, and identified during the assessment.

- Funding has not scaled with population growth to take the System to the next level of development.
- There has been a decentralization of responsibility within the System, with an imbalance between delegation of responsibilities and resources distributed to regions.
- Regions are significantly under-resourced for their contractual responsibilities.
- There is a lack of strong public, community, and legislative engagement within the System.
- There is a lack of surge capacity within the System.
- The System is at a good point to reassess its vision and future direction.

PRIORITY RECOMMENDATIONS

From the list of all recommendations proposed by the ACS TSC Review Team for the 2019 State of Washington TSC, a select group of recommendations was identified as requiring the most focus and attention by the State's Trauma System, over the next few years. By addressing this select group of Priority Recommendations first, the State will be better aligned to address the general recommendations proposed for each of the 18 Essential Trauma System Element Sections presented within this TSC Report.

Injury Epidemiology

- Perform a formal data-based gap analysis of the Washington State Trauma System.

- Develop and disseminate a standard Trauma System Report for the lead agency and regional system stakeholders to drive Emergency Care System Strategic Plan advancement.

Indicators as a Tool for System Assessment

- Develop trauma system indicators with benchmarks that are tied to strategic plan goals.

Coalition Building and Community Support

- Realign the composition of the eight EMS and Trauma Regional Councils with that of the State EMS and Trauma Care Steering Committee to ensure adequate representation of all stakeholders in regional systems planning and oversight.

Lead Agency and Human Resources within the Lead Agency

- Establish a contracted Medical Director position, dedicated to trauma within the lead agency. This should be a trauma surgeon with responsibilities to provide greater support to trauma system development.

- Establish a contracted Medical Director position for the EMS, Trauma, Cardiac and Stroke Care System in the lead agency. This should be an emergency physician with responsibilities to provide consistent statewide support to the local EMS Medical Directors.

Trauma System Plan

- Review the current statute pertaining to the Trauma System Plan (RCW 70.168.030).
    - Assemble the multidisciplinary EMS and Trauma Care Steering Committee to write a comprehensive EMS and Trauma System Plan that aligns with the requirements of the statute.
    - Operationalize the EMS and Trauma System Plan using the results of the analysis through consensus-based goals and objectives.
    - Revise Regional Plans to be consistent with the revised EMS and Trauma System Plan.

System Integration

- Ensure that EMS assets are strategically placed and sufficient in number to meet the needs of the state's population, including air and critical care ground transport.

Financing

- Seek additional and sustainable system-wide funding to support the EMS, Trauma, Cardiac and Stroke Care System.
    - Consider appointing a sub-committee of the Steering Committee to develop a strategy to increase system-wide funding.
- Increase the regional funding to meet the needs of current regionalization efforts.

Emergency Medical Services

- Mandate that all EMS agencies submit data into the WEMSIS system, and develop data linkages with the trauma registry.
- Ensure trauma destination protocols are consistently followed by EMS agencies.
- Establish an objective and standardized statewide process to revise the Minimum and Maximum criteria for the number of EMS agencies in the system.

Definitive Care Facilities

- Establish a clear and transparent process for calculation of minimum/ maximum numbers for trauma centers in each region, based on a uniform statewide approach with potential for regional adjustment.
- Re-evaluate the purpose and function of the Level I trauma center role and adjust requirements as necessary.

System Coordination and Patient Flow

- Provide stronger state-level support for regional operations, especially in the areas of data analysis, capacity assessment, and quality assurance.

Disaster Preparedness

- Develop a regional contingency plan and system redundancy plan in the event Level I and II centers become incapacitated.

System-wide Evaluation & Quality Assurance

- Develop a master plan for system performance improvement at the state and regional levels to implement and complete data-driven performance improvement initiatives.

Trauma Management Information Systems

- Ensure that trauma registry data are systematically used for trauma system development, evaluation, and performance improvement.

TRAUMA SYSTEM ASSESSMENT

Injury Epidemiology

Purpose and Rationale[1]

Injury epidemiology is concerned with the evaluation of the frequency, rates, and pattern of injury events in a population. Injury pattern refers to the occurrence of injury-related events by time, place, and personal characteristics (for example, demographic factors such as age, race, and sex) and behavior and environmental exposures, and, thus, it provides a relatively simple form of risk- factor assessment.

The descriptive epidemiology of injury among the whole jurisdictional population (geographic area served) within a trauma system should be studied and reported. Injury epidemiology provides the data for public health action and becomes an important link between injury prevention and control and trauma system design and development. Within the trauma system, injury epidemiology has an integral role in describing the root causes of injury and identifying patterns of injury so that public health policy and programs can be implemented. Knowledge of a Region's injury epidemiology enables the identification of priorities for directing better allocation of resources, the nature and distribution of injury prevention activities, financing of the system, and health policy initiatives.

The epidemiology of injury is obtained by analyzing data from multiple sources. These sources might include vital statistics, hospital administrative discharge databases, and data from emergency medical services (EMS), emergency departments (EDs), and trauma registries. Motor-vehicle crash data might also prove useful, as would data from the criminal justice system focusing on interpersonal conflict. It is important to assess the burden of injury across specific population groups (for example, children, elderly people and ethnic groups) to ensure that specific needs or risk factors are identified. It is critical to assess rates of injury appropriately and thus, to identify the appropriate denominator (for example, admissions per 100,000 population). Without such a measure, it becomes difficult to provide valid comparisons across geographic Regions and over time.

To establish injury policy and develop an injury prevention and control plan, the trauma system, in conjunction with the state or Regional epidemiologist, should complete a risk assessment and gap analysis using all available data. These data allow for an assessment of the "injury health" of the population (community, state, or Region) and will allow for the assessment of whether injury prevention programs are available, accessible, effective, and efficient.

An ongoing part of injury epidemiology is public health surveillance. In the case of injury surveillance, the trauma system provides routine and systematic data collection and, along with its partners in public health, uses the data to complete injury analysis, interpretation, and

[1] See Appendix B Methodology for a description of and references for the Purpose and Rationale and Optimal Elements for each core section.

dissemination of the injury information. Public health officials and trauma leaders should use injury surveillance data to describe and monitor injury events and emerging injury trends in their jurisdictions; to identify emerging threats that will call for a reassessment of priorities and/or reallocation of resources; and to assist in the planning, implementation, and evaluation of public health interventions and programs.

Optimal Elements

I. There is a thorough description of the epidemiology of injury in the system jurisdiction using population-based data and clinical databases. **(B-101)**

- **a.** There is a thorough description of the epidemiology of injury mortality in the system jurisdiction using population-based data. **(I-101.1)**

- **b.** There is a description of injuries within the trauma system jurisdiction, including the distribution by geographic area, high-risk populations (pediatric, elderly, distinct cultural/ethnic, rural, and others), incidence, prevalence, mechanism, manner, intent, mortality, contributing factors, determinants, morbidity, injury severity (including death), and patient distribution using any or all the following: vital statistics, ED data, EMS data, hospital discharge data, state police data (data from law enforcement agencies), medical examiner data, trauma registry, and other data sources. The description is updated at regular intervals. **(I-101.2)**
  Note: Injury severity should be determined through the consistent and system-wide application of one of the existing injury scoring methods, for example, Injury Severity Score (ISS).

- **c.** There is comparison of injury mortality using local, Regional, statewide, and national data. **(I-101.3)**

- **d.** Collaboration exists among EMS, public health officials, and trauma system leaders to complete injury risk assessments. **(I-101.4)**

- **e.** The trauma system works with EMS and public health agencies to identify special at-risk populations. **(I-101.7)**

II. Collected data are used to evaluate system performance and to develop public policy. **(B-205)**

- **a.** Injury prevention programs use trauma management information system data to develop intervention strategies. **(I-205.4)**

III. The trauma, public health, and emergency preparedness systems are closely linked. **(B-208)**

- **a.** The trauma system and the public health system have established linkages, including programs with an emphasis on population based public health surveillance and evaluation for acute and chronic traumatic injury and injury prevention. **(I-208.1)**

IV. The jurisdictional lead agency, in cooperation with the other agencies and organizations, uses analytic tools to monitor the performance of population-based prevention and trauma care services. **(B-304)**

a. The lead agency, along with partner organizations, prepares annual reports on the status on injury prevention and trauma care in the state, Regional, or local areas. **(I-304.1)**

b. The trauma system management information system database is available for routine public health surveillance. There is concurrent access to the databases (ED, trauma, prehospital, medical examiner, and public health epidemiology) for the purpose of routine surveillance and monitoring of health status that occurs regularly and is a shared responsibility. **(I-304.2)**

Current Status

The State of Washington has an epidemiologist with 1.0 full-time equivalent (FTE) dedicated exclusively to trauma program activities. The trauma program also has registry staff to support the epidemiology function of the program. These positions are supported by General State Funds through the Department of Health. Agency and organizational requests for injury data to support independent trauma-related projects are supported by the epidemiologist on an ad hoc basis. The trauma epidemiologist makes a concerted effort to be expeditiously responsive to data requests and has been instrumental in outreach by frequently traveling to EMS and Trauma Regions QI Committee meetings to facilitate presentation and understanding of the data and analysis. However, the sheer breadth of responsibility and volume of data requirements imposed upon the epidemiologist are at times overwhelming.

Data resources available to the state trauma epidemiology staff to augment the trauma registry include:

- Washington State Death certificates
- Comprehensive Hospital Abstract Reporting System (CHARS) hospital discharge data from the Washington Department of Health Center for Health Statistics
- Washington Behavioral Risk Factor Surveillance System (BRFSS) data Healthy Youth Survey
- Washington State Patrol Toxicology Lab data, specifically for surveillance of opioid epidemic
- Trauma Rehabilitation data from Trauma Rehab designated facilities.

In the future, plans have been developed to incorporate data from the Rapid Health Information System (RHINO), which compiles emergency department data from the State and the Washington State Emergency Medical Services Information System (WEMSIS) data. In addition, the Department may request data from medical examiners and coroners to support the registry. Though procedures to establish a uniform data linkage from different sources were cited in rule, this does not appear to have been accomplished to date. This linkage capability would have profound impact on trauma system development. Integrating the composite spectrum of data across the continuum of care would substantively advance the capacity to perform concurrent injury surveillance and support the comprehensive trauma system performance improvement process.

The registry was developed to meet the requirements established by Washington State statute RCW 70.168.060 / 70.168.090 and administrative code WAC 246-976-420 / WAC 246-976-430 with the expressed purpose of the trauma registry delineated as follows:

- Provide data for injury surveillance, analysis, and prevention programs
- Monitor and evaluate the outcome of care of major trauma patients, in support of statewide and regional quality assurance, and system evaluation activities
- Assess compliance with state standards for trauma care
- Provide information for resource planning, system design, and management
- Provide a resource for research and education

Several fundamental issues substantively affect the State's ability to effectively develop a comprehensive Washington trauma registry and subsequently utilize this injury data for trauma system development. Though trauma data reporting is required by state rule, timely and complete data submission is not consistent across the system components. Likewise, it is unclear if there is a consistent process to evaluate trauma data quality at the state level. An important aspect of a State's trauma epidemiology function is the production of reports to inform stakeholders of the status of the trauma system and drive subsequent quality improvement initiatives. The reports expressly required by Washington State rule include annual summary statistics and trends for demographic and related information about trauma care for the state and for each EMS/TC region. In addition, the set requirement mandates reporting on outcome measures intended to drive system-wide evaluation and regional quality improvement programs. These reports have not been ubiquitously generated and disseminated by the Department of Health. This lack of salient injury specific data has substantively limited the potential for trauma system development, particularly in the realm of trauma quality improvement. Likewise, the data has not been reported in a format that informs elected officials and the general public about the value of the trauma system in the State of Washington.

Recommendations

- **Perform a formal data-based gap analysis of the Washington State Trauma System.**

- **Develop and disseminate a standard Trauma System Report for the lead agency and regional system stakeholders to drive Emergency Care System Strategic Plan advancement.**

- Develop an internal policy and procedure for data requests and release of information.

- Integrate data from the entire continuum of trauma care including medical examiner, prehospital, rehabilitation, and post-discharge status.

- Design a standard process to identify trauma system performance improvement issues.

- Expand the focus of injury epidemiology to highlight injury outcomes in context of the trauma system.

- Produce a trauma system "fact sheet" to inform legislators and the public about the critical value of their trauma system.

- Develop and implement strategies to augment data analytic capability to improve responsiveness to stakeholder requests.

Indicators as a Tool for System Assessment

Purpose and Rationale

In the absence of validated national benchmarks, or norms, the benchmarks, indicators and scoring (BIS) process included in the Health Resources and Services Administration's (HRSA) *Model Trauma System Planning and Evaluation* document provides a tool for each trauma system to define its system-specific health status benchmarks and performance indicators and to use a variety of community health and public health interventions to improve the community's health status. The tool also addresses reducing the burden of injury as a community-wide public health problem, not strictly as a trauma patient care issue.

This BIS tool provides the instrument and process for a relatively objective state and sub-state (regional) trauma system self-assessment. The BIS process allows for the use of state, Regional, and local data and assets to drive consensus responses to the BIS. It is essential that the BIS process be completed by a multidisciplinary stakeholder group, most often the equivalent of a state trauma advisory committee. The BIS process can help focus the discussion on various system strengths and weaknesses, can be used to set goals or benchmarks, and provides the opportunity to target often limited resources and energies to the areas identified as most critical during the consensus process. The BIS process is useful to develop a snapshot of any given system at a moment in time. However, its true usefulness is in repeated assessments that reveal progress toward achieving various benchmarks identified in the previous application of the BIS. This process further permits the trauma system to refine goals to be attained before future reassessments using the tool.

Optimal Element

I. Assurance to constituents that services necessary to achieve agreed-on goals are provided by encouraging actions of others (public or private), requiring action through regulation, or providing services directly. **(B-300)**

Current Status

In 2006, a workgroup consisting of representation from the Department of Health, the EMS and Trauma Care Steering Committee, the technical advisory committees, and additional stakeholders completed the HRSA Benchmarks, Indicators, and Scoring (BIS) assessment. This work provided the impetus and framework for the Trauma System's subsequent interval strategic planning process.

The State of Washington is currently exploring the implementation of an ACS Trauma Quality Improvement Program (TQIP) Collaborative for Level I and II centers. A collaborative effort to share risk-adjusted outcomes will provide the state with insights into system level issues across the continuum of trauma care. While each trauma center should be scrutinizing their individual outcomes, solutions at the hospital level, alone, may not have the impact required to improve the overall trauma system. Challenges related to pre-hospital care and transfer are best addressed through collaboration among trauma centers within the state. Routine use of system level risk adjusted outcomes will give the foundation for proactive quality improvement for the trauma system.

Recommendations

- **Develop trauma system indicators with benchmarks that are tied to strategic plan goals.**

- Establish a statewide collaborative effort to share risk-adjusted outcomes data and best practices.

TRAUMA SYSTEM POLICY DEVELOPMENT

Statutory Authority and Administrative Rules

Purpose and Rationale

Reducing morbidity and mortality due to injury is the measure of success of a trauma system. A key element to this success is having the legal authority necessary to improve and enhance care of injured people through comprehensive legislation and through implementing regulations and administrative code, including the ability to regularly update laws, policies, procedures, and protocols. In the context of the trauma system, comprehensive legislation means the statutes, regulations, or administrative codes necessary to meet or exceed a pre-described set of standards of care. It also refers to the operating procedures necessary to continually improve the care of injured patients from injury prevention and control programs through post-injury rehabilitation. The ability to enforce laws and rules guides the care and treatment of injured patients throughout the continuum of care.

There must be sufficient legal authority to establish a lead trauma agency and to plan, develop, maintain, and evaluate the trauma system during all phases of care. In addition, it is essential that as the development of the trauma system progresses, included in the legislative mandate are provisions for collaboration, coordination, and integration with other entities also engaged in providing care, treatment, or surveillance activities related to injured people. A broad approach to policy development should include the building of system infrastructure that can ensure system oversight and future development, enforcement, and routine monitoring of system performance; the updating of laws, regulations or rules, and policies and procedures; and the establishment of best practices across all phases of intervention. The success of the system in reducing morbidity and mortality due to traumatic injury improves when all service providers and system participants consistently comply with the rules, have the ability to evaluate performance in a confidential manner, and work together to improve and enhance the trauma system through defined policies.

Optimal Elements

I. Comprehensive state statutory authority and administrative rules support trauma system leaders and maintain trauma system infrastructure, planning, oversight, and future development. **(B-201)**

- **a.** The legislative authority states that all the trauma system components, emergency medical services (EMS), injury control, incident management, and planning documents work together for the effective implementation of the trauma system (infrastructure is in place). **(I-201.2)**

- **b.** Administrative rules and regulations direct the development of operational policies and procedures at the state, Regional, and local Levels. **(I-201.3)**

II. The lead agency acts to protect the public welfare by enforcing various laws, rules, and regulations as they pertain to the trauma system. **(B-311)**

a. Laws, rules, and regulations are routinely reviewed and revised to continually strengthen and improve the trauma system. **(I-311.4)**

Current Status

In 1990, the Washington State Legislature passed the EMS and Trauma Care System Act (RCW Title 70 Section 168). The law authorized the Department of Health to adopt and promulgate rules to govern the Washington EMS and Trauma Care System.

The Washington Department of Health, by statute, serves as the lead agency for the State Trauma System (RCW 70.168.050). Within the Department, the Emergency Care Systems office is located in the Health Systems Quality Assurance Division and has the responsibility for program development and operation of the system.

The legislation also established the statewide EMS and Trauma Care Steering Committee (RCW 70.168.020), defined its membership, and designated its responsibilities. The Committee is charged with advising the Department of Health regarding emergency medical services and trauma care needs throughout the state. It establishes local and regional emergency medical services and trauma care councils with power and duties (RCW 70.168.120). The legislation also provides the Department authority to enact rules to establish a grant program for designated trauma care services (RCW 70 168.135).

The legislation is comprehensive and provides the department authority for system development and monitoring. There has been much progress with some significant advancement since the enactment of the 1990 legislation. The legislature has provided the Department with sufficient authority to regulate the EMS and Trauma Care System. In addition, the statute provides peer review protection for the systems peer review activities.

In 1997, the legislature passed trauma reimbursement legislation that allows the use of Medicaid funds for trauma care reimbursement. RCW 70 168.040 establishes the EMS and Trauma Care System trust account. Funds deposited into this account are from new and leased vehicle sales and traffic moving violations. Expenditures are for the purposes of the state trauma care system, including emergency medical services, trauma care services, rehabilitative services, and the planning and development of related services.

RCW 70 168.130 authorizes the Department, with the assistance of the EMS and Trauma Care Steering Committee, to adopt a program for the disbursement of funds for the development, implementation, and enhancement of the EMS and Trauma Care System.

The minimum and maximum criteria to determine needed services have historically proven to be an advantage and strength within the system. However, with marked population increases since its inception, the process has not evolved to account for the change in demand for trauma care services. The EMS and trauma system should establish a standardized and objective process to periodically review and revise the minimum and maximum criteria for all levels of trauma center designations and EMS services in the system. Air medical and critical care ground services are not currently addressed in the criteria. Consideration should be made to integrate these critical trauma system elements into the next iteration of the criteria. The goal

should be to make the EMS and trauma center criteria objective enough to minimize the need for exceptions.

Since the inception of the EMS and Trauma law, other time critical services to include stroke and cardiac were added to the EMS and Trauma Care System in 2010 per RCW 70.168.050. Current statutes need to be revised or established to address these new areas of responsibilities. Funding also needs to be identified to support these additional areas in order not to diminish the current funding for the EMS and trauma system.

Finally, since the statutes originated in 1990, the system needs to perform a comprehensive review of the current laws and rules to determine if there are statutes that are no longer applicable in the system. This review may also identify areas where more statutory changes may be needed to continue improvement of the system.

Recommendations

- Update statutes to include additional time critical services that have been added to the EMS, Trauma, Cardiac and Stroke Care System.

- Review and repeal outdated statutes.

- Establish an objective and standardized statewide process to revise the Minimum and Maximum criteria for all trauma designation levels.

System Leadership

Purpose and Rationale

In addition to lead agency staff and consultants (for example, trauma system medical director), there are other significant leadership roles essential to developing mature trauma systems. A broad constituency of trauma leaders includes trauma center medical directors and nurse coordinators, prehospital personnel, injury prevention advocates, and others. This broad group of trauma leaders works with the lead agency to inform and educate others about the trauma system, implements trauma prevention programs, and assists in trauma system evaluation and research to ensure that the right patient, right hospital, and right time goals are met. There is a strong role for the trauma system leadership in conveying trauma system messages, building communication pathways, building coalitions, and collaborating with relevant individuals and groups. The marketing communication component of trauma system development and maintenance begins with a consensus-built public information and education plan. The plan should emphasize the need for close collaboration between coalitions and constituency groups and increased public awareness of trauma as a disease. The plan should be part of the ongoing and regular assessment of the trauma system and be updated as frequently as necessary to meet the changing environment of the trauma system.

When there are challenges to providing the optimal care to trauma patients within the system, the leadership needs to effect change to produce the desired results. Broad system improvements require the ability to identify challenges and the resources and authority to make changes to improve system performance. However, system evaluation is a shared responsibility. Although the leadership will have a key role in the acquisition and analysis of system performance data, the multidisciplinary trauma oversight committee will share the responsibility of interpreting those data from a broad systems perspective to help determine the efficiency and effectiveness of the system in meeting its stated performance goals and benchmarks. All stakeholders have the responsibility of identifying opportunities for system improvement and bringing them to the attention of the multidisciplinary committee or the lead agency. Often, subtle changes in system performance are noticed by clinical care providers long before they become apparent through more formal evaluation processes.

Perhaps the biggest challenge facing the lead agency is to synergize the diversity, complexity, and uniqueness of individuals and organizations into an integrated system for prevention of injury and for the provision of quality care for injured patients. To meet this challenge, leaders in all phases of trauma care must demonstrate a strong desire to work together to improve care provided to injured victims.

Optimal Elements

I. Trauma system leaders (Lead Agency, trauma center personnel, and other stakeholders) use a process to establish, maintain, and constantly evaluate and improve a comprehensive trauma system in cooperation with medical, professional, governmental, and other citizen organizations. **(B-202)**

II. Collected data are used to evaluate system performance and to develop public policy. **(B-205)**

III. Trauma system leaders, including a trauma-specific statewide multidisciplinary, multiagency advisory committee, regularly review system performance reports. **(B-206)**

IV. The lead agency informs and educates state, Regional, and local, constituencies and policy makers to foster collaboration and cooperation for system enhancement and injury control. **(B-207)**

Current Status

The substantive lead agency administrative architecture for the Emergency Medical Services and Trauma System exists within the Office of Community Health Systems, Health Systems Quality Assurance Division at the Washington State Department of Health. The Emergency Medical Services and Trauma System supports the philosophy of a strong operational trauma system led by the Executive Director for the Emergency Care System (includes EMS, Trauma, Cardiac and Stroke), who has been a long-standing passionate leader and advocate for system development within the state. A significant responsibility of the system is to protect the health, safety, and welfare of the public by assuring that emergency medical services and trauma care provided by ambulance services, emergency medical response agencies, training entities, and emergency medical services personnel maintain compliance with established, evidence-based standards.

The principal functional effective component for trauma system development established by the EMS and Trauma System is the EMS and Trauma Care Steering Committee. The Steering Committee members are exclusively volunteers appointed by the Washington State Secretary of Health. The principal roles of the Steering Committee are to provide subject matter expertise and advise the Department of Health on issues relating to the trauma system within the state, to evaluate Regional EMS and Trauma Care Plans, and to review and propose revisions for administrative rule for EMS and trauma care. The Steering Committee is stated to consist of 30 members representing surgery, emergency medicine, pediatric care, hospitals, EMS, firefighters, local health departments, and consumers distributed by geography and are intended to broadly represent the interests of the trauma system constituents. Upon reviewing the current membership of the Steering Committee, the ACS TSC Review Team noted that the membership did not appear to represent the broad regional diversity of an inclusive trauma system and additionally specifically noted that the public position was vacant. The Committee meets every other month and has appointed Technical Advisory Committees (TACs) led by a member of the Steering Committee, to provide expert advice and support the implementation of the system strategic plan (aka EMS and Trauma Plan). These TACs include the following: Cost Reimbursement TAC, Emergency Cardiac and Stroke TAC, Hospital TAC, Pediatric TAC, Prehospital TAC, Quality Outcomes TAC, Regional Advisory TAC, and the Rehabilitation TAC. These TACs provide more granular insight into the operations and function of the trauma system that support Steering Committee initiatives and decision making.

Regional EMS and Trauma Care Councils (EMSTs) are established in state statute (RCW 70.168.100) and administrative rule (70.168.120) and charged with oversight and management of specific regional trauma system needs. Each EMS and Trauma Region is mandated to assess, analyze, identify, and recommend resource needs for the regions, but they are substantively underfunded to meet these requirements. In addition, the EMS and Trauma Region Councils do not appear to have effectively engaged the broader trauma stakeholder community within their respective regions. Consequently, the substantive operational product of the EMS and Trauma Regions Councils appears to be significantly limited due to the fundamental constraints of resources and inconsistent stakeholder participation.

The Washington State EMS and Trauma System is fortunate to have a substantial number of strong and committed leaders with expertise and longevity in trauma system development. Mentoring the next generation of system leaders and a solid leadership succession plan will be critical to the continued success and evolution of the Washington State Trauma System.

Recommendations

- Foster implementation of trauma system benchmarking per national standards.
- Promulgate the shared vision and mission to guide the evolution of the Washington State trauma system.
- Augment the Washington State Department of Health staff with both a dedicated EMS Medical Director and a Trauma Medical Director to provide system oversight and advance the vision and mission of the trauma system.
- Develop and disseminate a comprehensive Washington State Trauma System Plan with broad stakeholder engagement to guide the evolution of the state and regional trauma systems.
- Support the functional development of all EMS and Trauma Regional Councils with broad stakeholder engagement.
- Promote the value of the Washington State trauma system to the general public and the legislature.
- Consider rebalancing the representation on the Steering Committee to appropriately reflect the constituency of trauma system stakeholders.

Coalition Building and Community Support

Purpose and Rationale

Coalition building is a continuous process of cultivating and maintaining relationships with constituents (interested citizens) in a state or Region who agree to collaborate on injury control and trauma system development. Key constituents include health professionals, trauma center administrators, prehospital care providers, health insurers and payers, data experts, consumers and advocates, policy makers, and media representatives. The coalition of key constituents comprises the trauma system's stakeholders. The involvement of these key constituents is important for the following:

- Trauma system plan development
- Regionalization: promoting collaboration rather than competition between trauma centers
- System integration
- State policy development: authorizing legislation and regulations
- Financing initiatives
- Disaster preparedness

The coalition should be effectively organized through the formation of multidisciplinary state and Regional advisory groups to coordinate trauma system planning and implementation efforts. Constituents also communicate with elected officials and policy leaders regarding the development and sustainability of the trauma system. Information and education are needed by constituents to be effective partners in policy development for trauma system planning. Regular communication about the status of the trauma system helps these key partners to recognize needs and progress made with trauma system implementation.

One of the most effective ways to educate elected officials and the public is through an organized public information and education effort that may involve a media campaign about the burden of injury in the state and the need for trauma system development. Information and education are important to reduce the incidence of injury in all age groups and to demonstrate the value of an effective trauma system when a serious injury occurs.

Optimal Element

I. The lead agency informs and educates state, regional, and local constituencies and policy makers to foster collaboration and cooperation for system enhancement and injury control. **(B-207)**

Current Status

The lead agency has a 30 member EMS and Trauma Care Steering Committee, which it identifies as its coalition efforts. While the positions on the Steering Committee are specified in state statute, this Steering Committee does not appear to have balanced representation of system stakeholders with designated seats for the composite array of system components. Committee members serve 9 year terms, and if a member becomes Chairman, he or she may serve additional years. Review of the current make-up of this Committee reveals that designated seats are not equal, giving more weight to some represented areas than others.

Consideration should be made to realign the composition of the Committee to ensure that all critical system components have an equal voice. Also, the seats designated for ACS are held largely by representatives from the Level I trauma center. Efforts should be made to ensure that there is representation for all levels of trauma centers in the system. The lead agency should consider re-evaluating system representation needs to ensure similar weight is given to all stakeholders and pursue amending the statute as needed to achieve this balance.

Greater efforts should be developed to build other coalitions to support trauma system development. Within the Department of Health, the independently functioning prevention and community health and emergency preparedness and response departments are natural areas of collaboration. Currently, the lead agency does not have any organized efforts to build coalitions of involved stakeholders from outside the trauma system components. Efforts should be made to engage external sources to advocate for system support and growth of the EMS and trauma system to the general public, local governments, and legislators. Valuable potential coalition partners to advance the system include local industry, community groups, local/regional media, and organizations such as MADD, and insurance institutes. Such coalitions can be invaluable to educate the public as to the importance of the trauma system and advocate to legislators the need to adequately fund the system.

The state is divided into 8 EMS and Trauma Regional Councils, each of which has a steering committee that is to mirror the state steering committee with the goal of building coalitions in each region. However, functionally there are only 6 Regional Councils, as some regions have combined due to size and financial constraints. There is great variability between regions as to regional steering committee levels of activity and engagement. In some higher population regions, Central and East, the committees are quite active. In smaller regions, it can be challenging to get more than a handful of individuals to participate.

While one of the contractual obligations of each regional council is to provide injury prevention programs, functionally their funding has been reduced to the point that many do not have the infrastructure to do so. There are inconsistencies between regions as to how much prevention activities are provided. Some Regional Councils have done a good job building coalitions with trauma centers in their jurisdictions to provide such programs, while others are so geographically distant that they have not been effective in doing so. Across the state, injury prevention efforts are largely occurring at designated trauma centers and within local public health district departments. The locations of local health district departments do not align with the designated EMS and Trauma Regional Council areas. As the regional councils are not adequately resourced to provide injury prevention activities, they must build effective coalitions to do so such as partnering with their local health districts and trauma centers to combine efforts.

Coalition building of trauma system advocates should also occur at the regional level engaging representation from concerned citizens, area industries, and community groups to serve as advocates for the system.

Recommendations

- **Realign the composition of the eight EMS and Trauma Regional Councils with that of the State EMS and Trauma Care Steering Committee to ensure adequate representation of all stakeholders in regional systems planning and oversight.**

- Increase engagement with strategic partners inside the Department of Health.

    - Partner with Prevention and Community Health to combine efforts to enhance prevention and trauma reduction activities.

    - Partner with Emergency Preparedness and Response to combine efforts to enhance disaster planning and response activities.

- Develop strategic partnerships with community programs such as MADD, the Injury and Violence Prevention Network, AARP, church groups, and Safe Kids to promote community awareness and partnership for injury reduction programs.

- Ensure all stakeholders have sufficient representation on the EMS and Trauma Care Steering Committee.

- Ensure that the EMS and Trauma Regional Councils network with local health districts and community groups for injury prevention efforts.

- Ensure that EMS and Trauma Regional Councils network with trauma centers in their regions.

- Provide sufficient resources to regional offices to allow for coalition building and community engagement.

Lead Agency and Human Resources within the Lead Agency

Purpose and Rationale

Each trauma system (state, Regional, local, as defined in state statute) should have a lead agency with a strong program manager who is responsible for leading the trauma system. The lead agency, usually a government agency, should have the authority, responsibility, and resources to lead the planning, development, operations, and evaluation of the trauma system throughout the continuum of care. The lead agency, empowered through legislation, ensures system integrity and provides for program integration with other health care and community-based entities, namely, public health, EMS, disaster preparedness, emergency management, law enforcement, social services, and other community-based organizations.

The lead agency works through a variety of groups to accomplish the goals of trauma system planning, implementation, and evaluation. The ability to bring multidisciplinary, multiagency advisory groups together to accomplish trauma system goals is essential in developing and maintaining the trauma system and is part of providing leadership to evolving and mature systems.

The lead agency's trauma system program manager coordinates trauma system design, the adoption of minimum standards (prehospital and in-hospital), and provides for overall system evaluation through performance indicator assessment and assurance. In addition to a trauma program manager, the lead agency must be sufficiently staffed to actively participate in each phase of development and in maintaining the system through a clearly defined structure for decision making (policies and procedures) and through proactive surveillance and evaluation. *Minimum* staffing usually consists of a trauma system program manager, data entry and analysis personnel, and monitoring and compliance personnel. Additional staff resources include administrative support and a part-time commitment from the public health epidemiology service to provide system evaluation and research support.

Within the leadership and governance structure of the trauma system, there is a role for strong physician leadership. This role is usually fulfilled by a full- or part-time trauma medical director within the lead agency.

Optimal Elements

I. Comprehensive state statutory authority and administrative rules support trauma system leaders and maintain trauma system infrastructure, planning, oversight, and future development. **(B-201)**

- **a.** The legislative authority (statutes and regulations) plans, develops, implements, manages, and evaluates the trauma system and its component parts, including the identification of the lead agency and the designation of trauma facilities. **(I-201.1)**

- b. The lead agency has adopted clearly defined trauma system standards (for example, facility standards, triage and transfer guidelines, and data collection standards) and has sufficient legal authority to ensure and enforce compliance. **(I-201.4)**.

II. Sufficient resources, including financial and infrastructure-related, support system planning, implementation, and maintenance. **(B-204)**

Current Status

The Washington Department of Health is designated as the lead agency by the authority of state statute RCW 70.168.050. The Emergency Care System is located within the Health Systems Quality Assurance Division in the State of Washington Department of Health and given the responsibility to oversee the EMS, Trauma, Cardiac and Stroke Care System. The agency is commended for its efforts to provide qualified staff resources in the EMS and trauma care program to meet the growing needs of the trauma system.

Leadership within the Department's Emergency Care System consists of a seasoned and experienced executive director with more than thirty years of service in the department. The agency has a relatively small staff for the responsibilities required to monitor the existing system. In 2010, stroke and cardiac was added to the EMS and Trauma Care System and in January 2019, there was an internal reorganization to accommodate the increased workload. These changes, along with changes occurring in healthcare, increasing population growth, and limited funding have created challenges for the agency. These challenges may have an impact on the Department's ability to effectively carry out the trauma system future requirements as the system continues to demand more resources.

Currently, the EMS, Trauma, Cardiac and Stroke Care System does not have a Trauma Medical Director focused solely on the development and management of the trauma system. Likewise, the system does not have an EMS Medical Director to provide guidance and advice to the Department in the clinical policy development for the System. An EMS Medical Director is also necessary to work collaboratively with the local EMS Medical Directors to assure statewide treatment and transport standards are in place and to provide education and monitoring to ensure statewide consistency for improvement of the System. The lead agency should consider appointing both a State Trauma Medical Director and a State EMS Medical Director. These positions can be contractual part-time FTE's.

Trauma program performance improvement is essential to the effectiveness of the trauma system. The department should establish a performance improvement coordinator position having the responsibility of monitoring for compliance of the statewide performance improvement efforts and assisting with performance improvement coordination at the regional level.

The lead agency is commended for providing 0.5 FTE staff resources to support the injury prevention efforts of the EMS, Trauma, Cardiac and Stroke Care System. Although this is an excellent resource available to the System, enough time is not currently allotted to carry out the needed responsibilities of this role. The department should increase the time allotment for this position to 1.0 dedicated FTE.

The current organizational structure and staff job responsibilities with regard to EMS, Trauma, Cardiac and Stroke Care System development and enforcement need to be reviewed. Job descriptions should be updated to reflect current responsibilities of the position(s) necessary to support the effective development and operation of the state's Trauma System.

The lead agency has the responsibility to monitor and ensure consistency in the regulatory requirements set forth in statute and administrative rules for the EMS, Trauma, Cardiac and Stroke Care System. Staffing levels need to be adequate to meet those needs and provide system accountability.

Recommendations

- **Establish a contracted Medical Director position, dedicated to trauma within the lead agency. This should be a trauma surgeon with responsibilities to provide greater support to trauma system development.**

- **Establish a contracted Medical Director position for the EMS, Trauma, Cardiac and Stroke Care System within the lead agency. This should be an emergency physician with responsibilities to provide consistent statewide support to the local EMS Medical Directors.**

- Hire 1.0 FTE State Trauma System PI Coordinator to support state and regional PI activities.

- Ensure system-wide accountability and consistency in the enforcement of the EMS and trauma statutes and rules.

- Review and update agency job descriptions to clearly define the staff roles and responsibilities as a result of the recent program re-organization.

- Increase the injury prevention resource staff from 0.5 to 1.0 FTE.

Trauma System Plan

Purpose and Rationale

Each trauma system, as defined in statute, should have a clearly articulated trauma system planning process resulting in a written trauma system plan. The plan should be built on a completed inventory of trauma system resources identifying gaps in services or resources and the location of assets. It should also include an assessment of population demographics, topography, or other access enhancements (location of hospital and prehospital resources) or barriers to access. It is important that the plan identify special populations (for example, pediatric, elderly, in need of burn care, ethnic groups, rural) within the geographic area served and address the needs of those populations within the planning process. A needs assessment (or other method of identifying injury patterns, patient care review/preventable death study) should also be completed for initial trauma system planning and updated periodically as needed to assess system changes over time.

The trauma system plan is developed by the lead trauma agency based on the results of a needs assessment and other data resources available for review. It describes the system design, integrated and inclusive, with adopted standards of care for prehospital and hospital personnel and a process to regularly review the plan over time. The plan is built on input from trauma advisory committees (or stakeholder groups) that assist in analyzing data, identifying resources, and developing system standards of care, including system policies and procedures and overall system design. Ideally, although every stakeholder group may not be satisfied with the plan or system design, the plan, to the extent possible, should be based on consensus of the advisory committees and stakeholder groups. These advisory groups should be able to review the plan before final adoption and approve the plan before it is submitted to the lead agency with authority for plan approval.

The trauma system plan is used to guide system development, implementation, and management. Each component of the trauma system (for example, prehospital, hospital, communications, and transportation) is clearly defined and an established service Level identified (baseline) with goals for enhancement (benchmark). Within the plan are incorporated other planning documents used to ensure integration of similar services and build collaboration and cooperation with those services. Service plans for emergency preparedness, EMS, injury prevention and control, public health, social services, and mental health are examples of services for which the trauma system plan should include an interface between agencies and services.

Optimal Element

I. The state lead agency has a comprehensive written trauma system plan based on national guidelines. The plan integrates the trauma system with EMS, public health, emergency preparedness, and incident management. The written trauma system plan is developed in collaboration with community partners and stakeholders. **(B-203)**

   a. The trauma system plan clearly describes the system design (including the components necessary to have an integrated and inclusive trauma system) and is used to guide system implementation and management. For example, the plan includes references to

regulatory standards and documents and includes methods of data collection and analysis. **(I-203.4)**

Current Status

The philosophy of the lead agency has been to evolve from a trauma system plan to an emergency care strategic plan to drive deliverables and accountability. It was reported that converting a statewide trauma system plan into a comprehensive emergency care system strategic plan that is inclusive of EMS, Trauma, stroke, and cardiac has been embraced by the stakeholders. Most feel that broadening the plan to emergency care has been beneficial as it strengthens the entire system. The goal was to use the trauma system to build on. It does not seem to distract from trauma. Rather, it broke down silos and has helped invigorate EMS. The result was more of a living document at the regional levels that is used in most of the regional meetings.

There is, however, the potential to lose focus on trauma with the current format of the strategic plan. The trauma stakeholders and DOH should ensure that “trauma" is not marginalized when creating the trauma system plan that is consistent with the statute. This may help to safeguard resources and funding necessary to adequately support the trauma system. In this regard, the title, mission, vision, challenges, and priorities in the State plan do not include the word “trauma”. Based on the information provided before, during and after the survey, it is clear that EMS strategies are blended in with the trauma strategies. Often times, especially in rural areas, this is an efficient method of operating. However, there does need to be clear allocation of time, effort, and financial support toward trauma. In addition, both at the state and regional levels, the plans need to include specific trauma language, and audit filters/core measures specific to the trauma patient population.

In reviewing the state trauma plan, it was observed that the plan does not contain the required information as outlined in statute RCW70.168.030. For example, it does not include components of a functional statewide trauma care system, including standards, an assessment of the current Trauma Care Program compared with the functional statewide model, an analysis of deficiencies, and the reasons for the deficiencies. The Trauma System Plan is to be updated every two years. Currently, it is reviewed annually by the EMS and Trauma Care Steering Committee and updated every 2 years.

The current document that was submitted as the state trauma system plan is titled “Washington State Emergency Care System Strategic Plan”. This document, in itself, is not comprehensive and lacks specificity. It was reported that the Regional strategic plans are an extension to the State’s plan. It was also noted that the System’s strategies and tactics are managed and tracked at the TAC level. Following the consultation, the TAC strategic work plans were provided to the consultation team and subsequently reviewed in detail. The System is to be commended for having these plans in place and including them in the overall strategic planning process. However, these plans are inconsistent in format, organization, and development. Additionally, it is unclear if the TAC strategic plans are accessible to the broader stakeholder community.

Ideally, a strategic plan is a document used to communicate organizational goals, objectives, and actions needed to achieve those goals with associated timelines, measurement, and metrics. Fundamentally, it is openly available to the broad stakeholder group to shape the direction of the organization’s future. The current strategic plan includes five goals and multiple objectives that are tied to the goals. Categories include cost reimbursement, emergency-

cardiac-stroke, hospital, injury-violence prevention, outcomes, pediatric, prehospital, regional advisory, and rehabilitation. “Trauma” is conspicuously absent. Three categories in the strategic plan include trauma focused objectives. These categories are hospital, injury-violence prevention, outcomes, pediatric, and rehabilitation.

The Emergency Medical Services and Trauma Region’s Strategic Plans are comprehensive. It appears there is a template provided to the regions for writing their strategic plans. The State’s goals and objectives drive the Regional Strategic Plans, and each objective has defined strategies with targeted timeframes for completion of deliverables. Also included are successes from the previous 1-2 years, min-max grids, and appendices, including various procedures and data reports.

By using the strategic plan, some benefits have been observed. The regional strategic plans seem to be able to move initiatives forward at the local level without detracting from trauma. This also allows for specificity in addressing issues at the local level. The plan has broken down silos between agencies, hospitals, specialty services and resulted in improved utilization of resources.

In the rural areas, including the Level III and IV trauma centers, some trauma program managers are responsible for stroke and cardiac. This allows for an efficient use of staffing resources, and has helped to combine trauma with the other time sensitive diseases because of scarce resources, and low volume of trauma patients. This has also improved the participation in performance improvement activities, regional meetings, and other EMS system-wide initiatives.

Recommendations

- **Review the current statute pertaining to the Trauma System Plan (RCW 70.168.030).**
    - **Assemble the multidisciplinary EMS and Trauma Care Steering Committee to write a comprehensive EMS and Trauma System Plan that aligns with the requirements of the statute.**
    - **Operationalize the EMS and Trauma System Plan using the results of the analysis through consensus-based goals and objectives.**
    - **Revise Regional Plans to be consistent with the revised EMS and Trauma System Plan.**

- Ensure TAC strategic work plans are consistent in regard to organization, formatting, development, and ensure regular updating.

System Integration

Purpose and Rationale

Trauma system integration is essential for the daily care of injured people and includes such services as mental health, social services, child protective services, and public safety. The trauma system should use the public health approach to injury prevention to contribute to reducing the entire burden of injury in a state or Region. This approach enables the trauma system to address primary, secondary, and tertiary injury prevention through closer integration with community health programs and mobilizing community partnerships. The partnerships also include mental health, social services, child protection, and public safety services. Collaboration with the public health community also provides access to health data that can be used for system assessment, development of public policy, and informing and educating the community.

Integration with EMS is essential because this system is linked with the emergency response and communication infrastructure and transports severely injured patients to trauma centers. Triage protocols should exist for treatment and patient delivery decisions. Regulations and procedures should exist for online and off -line medical direction. In the event of a disaster affecting local trauma centers, EMS would have a major role in evacuating patients from trauma centers to safety or to other facilities or to make beds available for patients in greater need.

The trauma system is a significant state and Regional resource for the response to mass casualty incidents (MCIs). The trauma system and its trauma centers are essential for the rapid mobilization of resources during MCIs. Preplanning and integration of the trauma system with related systems (public health, EMS, and emergency preparedness) are critical for rapid mobilization when a disaster or MCI occurs. The extensive impact of disasters and MCIs on the functioning of trauma centers and the EMS and public health systems within the affected Region or state must be considered, and joint planning for optimal use of all resources must occur to enable a coordinated response to an MCI. Trauma System leaders need to be actively involved in emergency management planning to ensure that trauma centers are integrated into the local, Regional, and state disaster response plans.

Optimal Elements

I. The state lead agency has a comprehensive written trauma system plan based on national guidelines. The plan integrates the trauma system with EMS, public health, emergency preparedness, and incident management. The written trauma system plan is developed in collaboration with community partners and stakeholders. **(B-203)**

- **a.** The trauma system plan has established clearly defined methods of integrating the trauma system plan with the EMS, emergency, and public health preparedness plans. **(I-203.7)**

II. The trauma, public health, and emergency preparedness systems are closely linked. **(B-208)**

Current Status

The lead agency does not have a comprehensive state trauma system plan. The state plan currently consists of goals, objectives, and outcomes in such categories as emergency, cardiac, and stroke, as well as cost reimbursement, pediatrics, and prehospital components. However, it lacks specificity and many of these areas do not reference trauma. In addition, neither the State Plan nor the Technical Advisory Committees (TAC) operational plans integrate public health or emergency preparedness, and incident management. From discussions with system stakeholders and the documentation, it appears that plans were developed with limited collaboration with community partners and stakeholders.

One of the regional council contract deliverables is a regional trauma system plan. A template for this is provided by the State. Some of the regional plans are quite detailed and trauma specific, while others are less developed. While the region councils are to be commended for the efforts they have placed in their trauma plans, the vision and responsibility for overall system planning must rest at the state level to ensure that all citizens have adequate resources and access to the trauma system.

The lead agency has placed a great deal of responsibility for system planning at the regional council level. This has resulted in disparities in access to trauma system components based on the location one resides in the state. This is particularly noted with EMS response times where more rural areas are challenged in terms of resources. The ultimate responsibility for promoting and securing adequate EMS resources rests at the state level. The lead agency should review, at least annually, EMS asset availability for the populace in each region of the state. There should be a plan to place resources where underserved areas are noted. Creation of a statewide dashboard of real time availability of EMS resources would help track assets and determine where reallocation or expansion is necessary. This real time dashboard should also include air and critical care EMS availability.

Methodology for allocating trauma system assets is based on a min/max number set at the regional council level. Although there is general overall guidance, each region applies this methodology differently and additional standardization would be helpful. This method lends itself to the potential for bias. This methodology has not changed since the trauma system's inception and seems to be based on historical convention rather than population based indicators. Reconsideration and updating of the methodology may help reduce disparities. System data should be used to inform these decisions.

Efforts are underway to link the trauma registry with other relevant databases, which at this point, are heavily siloed. Prioritization of this effort should occur in order to make data driven decisions to guide system enhancements. For example, it is reported that there are ongoing diversion issues due to bed availability with some Level II trauma centers statewide. However, these issues are not systematically tracked in a way that would provide information in real time to inform other trauma system components. Clean data could track and clarify the extent of this issue. The lead agency should ensure development of a dashboard that is accessible to all system components to allow real time knowledge of bed availability within the trauma system. This information could then be tracked and reviewed by the EMS and Trauma Care Steering Committee on a regular basis for quality improvement efforts and action as necessary.

Within the trauma system itself, there are system integration opportunities. Trauma centers are quite variable in sharing patient outcome information with EMS agencies. EMS agencies do have an electronic patient record platform, but are not required to use it, and it is not integrated

into the trauma registry platform. Trauma centers have difficulties getting EMS patient care reports, which are required by trauma registries. Some EMS agencies are still using paper rather than electronic platforms for patient reports. There are statewide patient care protocols that set response time standards and destination algorithms for trauma patients, but there is no ability to review EMS compliance at any level due to reporting inconsistencies. There is variation with respect to EMS agency and medical program director (MPD) representation on regional quality improvement and oversight committees. EMS and MPDs are essential parts of the trauma system and must be integrated into all regional quality and oversight structures. Law enforcement and public safety integration is inconsistent between regional councils. They are also important components of the system. Such linkages should begin at the lead agency level, followed by directives from the agency to the respective regional and local divisions to develop such linkages within their regions.

One critical component to the trauma system is the Public Safety Answering Points (PSAP) or E-911 centers. Integration of these is particularly lacking. These centers are the entry point of trauma patients into the system and thus critical to system performance. PSAPs are under the authority of the military health system, and there is very little if any military participation in trauma system advisory committees on both a state and regional basis. The lead agency must partner with the military health system to ensure meaningful involvement of PSAPs into trauma system oversight and quality improvement activities.

The trauma system also is currently not well integrated with other outside agencies or divisions that ideally would support the trauma mission. This specifically includes emergency preparedness and management, military systems, military health, and public safety. Assuring trauma system integration with these entities would enhance disaster preparedness and response as well as provide depth to the current system.

Recommendations

- **Ensure that EMS assets are strategically placed and sufficient in number to meet the needs of the state's population, including air and critical care ground transport.**

- Develop, or maintain through partnership, a real time searchable database of available beds within the Statewide Trauma System that is accessible to all system end users.

- Integrate Public Safety Answering Points (PSAPs), or E-911 centers as active partners in all areas of the trauma system, especially in planning and quality improvement efforts.

- Ensure that EMS services and Medical Program Directors (MPDs) are consistently represented in all EMS and trauma regional committee, planning, and oversight structures.

- Collect data on the percent of time trauma centers are on diversion.
    - This should be reviewed by the EMS and Trauma Care Steering Committee at each committee meeting for review, analysis, and corrective action if necessary.

- Develop a statewide or regional dashboard to allow hospitals and EMS services to have real time knowledge of available resources.

Financing

Purpose and Rationale

Trauma systems need sufficient funding to plan, implement, and evaluate a statewide or Regional system of care. All components of the trauma system need funding, including prehospital, acute care facilities, rehabilitation, and prevention programs. Lead agency trauma system management requires adequate funding for daily operations and other important activities such as advisory committee meetings, development of regulations, data collection, performance improvement, and public awareness and education. Adequate funding to support the operation of trauma centers and their state of readiness to care for seriously injured patients within the state or Region is essential. The financial health of the trauma system is essential for ensuring its integrity and its improvement over time.

The trauma system lead agency needs a process for assessing its own financial health, as well as that of the trauma system. A trauma system budget should be prepared, and costs should be reported by each component, if possible. Routine collection of financial data from all participating health care facilities is encouraged to fully identify the costs and revenues of the trauma system, including costs and revenues pertaining to patient care, administrative, and trauma center operations. When possible, the lead agency financial planning should integrate with the budgets and costs of the EMS system and disaster, rehabilitation, and prevention programs to enable development of a comprehensive financial health report.

Trauma system financial planning should be related to the trauma plan outcome measures (for example, patient outcome measures such as mortality rates, length of stay, and quality-of-life indicators). Such information may demonstrate the value added by having a trauma system in place.

Optimal Elements

I. Sufficient resources, including financial and infrastructure-related, support system planning, implementation, and maintenance. **(B-204)**

- **a.** Financial resources exist that support the planning, implementation, and ongoing management of the administrative and clinical care components of the trauma system. **(I 204.2)**
- **b.** Designated funding for trauma system infrastructure support (lead agency) is legislatively appropriated. **(I-204.3)**
- **c.** Operational budgets (system administration and operations, facilities administration and operations, and EMS administration and operations) are aligned with the trauma system plan and priorities. **(I-204.4)**

II. The financial aspects of the trauma systems are integrated into the overall performance improvement system to ensure ongoing fine tuning and cost-effectiveness. **(B-309)**

a. Collection and reimbursement data are submitted by each agency or institution on at least an annual basis. Common definitions exist for collection and reimbursement data and are submitted by each agency. **(I-309.2)**

Current Status

Washington has several strengths regarding the funding for the development and sustainability of a statewide trauma system. The State is to be commended for its historical proactive approach in identifying funding sources for establishing and supporting the system. The State General Funds allow for lead agency administrative and staff funding. State General Funds also support the EMS and Trauma Care Regional Councils, and contracts are in place to support regional staff and activities.

The legislature established the EMS and Trauma Care Trust Fund that is funded through motor vehicle sales, lease fees, and motor vehicle moving violation fees. Additionally, in 1997, the legislature authorized the use of Medicaid funding to support trauma care reimbursement. The EMS and Trauma Care Steering Committee's Cost Technical Advisory Committee advises the Steering Committee on the spending plan and disbursement of the funds.

Although these strengths have contributed to the success of the current EMS and trauma system, there are opportunities and challenges that remain. Changes in healthcare and increased population present challenges to further system growth. The Department, with advice from the EMS and Trauma Care Steering Committee, should identify areas of need and develop a system strategy for obtaining increased system-wide funding.

Since the current funding model was established, there have been several changes in the system. Two time critical services (stroke and cardiac) have been added with no additional sustainable funding. The Department should identify independent sources of revenue to support these additional responsibilities. Part of the system strategy should be the consideration of increasing the current motor vehicle fees dedicated to the Trust Fund.

Additional funding is needed for the Department and regional activities. Regional funding is currently provided through contracts for the eight regions but is insufficient to meet identified contractual requirements. Increased regional funding could be used to enhance violence and injury prevention programs, EMS educational activities, and potentially provide grants for EMS equipment to enhance system readiness and trauma response. The contracts are general in nature and not performance based. The Department, through recommendations from the EMS and Trauma Care Steering Committee, needs to establish performance-based contracts for each region and clearly define the activities to be carried out for the department.

As part of the contracts with the EMS and Trauma Regions, an administrative cost cap should be included to ensure sufficient funds are going to the local level to meet the deliverable expectations of the department for system-wide improvement.

The reviewers identified an over-arching theme, which was a concern for trauma funding. There has not been an increase in funding since 1997. As the state's population has grown substantially since then, there is a need for increased funding for trauma to adequately meet the program's needs. There is also a need for separate funding for stroke and cardiac. These additional programs have been over-laid onto the trauma system without an additional state funding source.

Recommendations

- **Seek additional and sustainable statewide funding to support the EMS, Trauma, Cardiac and Stroke Care System.**
    - **Consider appointing a sub-committee of the EMS & Trauma Care Steering Committee to develop a strategy to increase system-wide funding.**
- **Increase the regional council funding to meet the needs of current regionalization efforts.**
    - Consider reallocating a portion of the Trauma Fund to support EMS and Trauma Regional Councils.
- Seek independent funding for the time critical services that have added additional responsibilities to the system.
- Increase the vehicle lease and sales fee as well as the fee for moving violations to support and sustain the statewide EMS and Trauma Cardiac and Stroke Care System.
- Establish performance-based contracts for each region and clearly define the activities to be carried out for the Department.

TRAUMA SYSTEM ASSURANCE

Prevention and Outreach

Purpose and Rationale

Trauma systems must develop prevention strategies that help control injury as part of an integrated, coordinated, and inclusive trauma system. The lead agency and providers throughout the system should be working with business organizations, community groups, and the public to enact prevention programs and prevention strategies that are based on epidemiologic data gleaned from the system.

Efforts at prevention must be targeted for the intended audience, well defined, and structured, so that the impact of prevention efforts is system-wide. The implementation of injury control and prevention requires the same priority as other aspects of the trauma system, including adequate staffing, partnering with the community, and taking advantage of outreach opportunities. Many systems focus information, education, and prevention efforts directly to the general public (for example, restraint use, driving while intoxicated). However, a portion of these efforts should be directed toward emergency medical services (EMS) and trauma care personnel safety (for example, securing the scene, infection control). Collaboration with public service agencies, such as the department of health is essential to successful prevention program implementation. Such partnerships can serve to synergize and increase the efficiency of individual efforts. Alliances with multiple agencies within the system, hospitals, and professional associations, working toward the formation of an injury control network, are beneficial.

Activities that are essential to the development and implementation of injury control and prevention programs include the following:

- A needs assessment focusing on the public information needed for media relations, public officials, general public, and third-party payers, thus ensuring a better understanding of injury control and prevention
- Needs assessment for the general medical community, including physicians, nurses, prehospital care providers, and others concerning trauma system and injury control information
- Preparation of annual reports on the status of injury prevention and trauma care in the system
- Trauma system databases that are available and usable for routine public health surveillance

Optimal Elements

I. The lead agency informs and educates state, Regional, and local constituencies and policy makers to foster collaboration and cooperation for system enhancement and injury control. **(B-207)**

a. The trauma system leaders (lead agency, advisory committees, and others) inform and educate constituencies and policy makers through community development activities, targeted media messaging, and active collaborations aimed at injury prevention and trauma system development. **(I-207.2)**

II. The jurisdictional Lead Agency, in cooperation with other agencies and organizations, uses analytic tools to monitor the performance of population based prevention and trauma care services. **(B-304)**

a. The Lead Agency, along with partner organizations, prepares annual reports on the status of injury prevention and trauma care in state, Regional, or local areas. **(I-304.1)**

III. The Lead Agency ensures that the trauma system demonstrates prevention and medical outreach activities within its defined service area. **(B-306)**

a. The trauma system is active within its jurisdiction in the evaluation of community based activities and injury prevention and response programs. **(I-306.2)**

b. The effect or impact of outreach programs (medical and community training and support and prevention activities) is evaluated as part of a system performance improvement process. **(I-306.3)**

Current Status

There are many injury prevention programs being implemented across the state by various local, county, and state agencies, as well as by hospitals and trauma centers. Many of these programs were listed in the pre-review questionnaire (PRQ). The levels of collaboration between agencies, prevention organizations, hospitals, and the lead agency appear to vary. There is an opportunity to increase collaborative efforts and strengthen partnerships. It was noted by the consultation team that the Department has limited capacity for exercising its leadership role in facilitating injury and violence prevention (IVP) efforts at the state/region/county levels.

There is specific legislation (WAC 246-976-700) requiring facilities with a designated trauma center to have injury prevention programs. Specifically, they are required to participate in a community or regional injury prevention program. This requirement is verified during the DOH trauma site survey process.

There is evidence of injury prevention activity being prioritized based on local or regional data. Falls are one of the leading causes of injury, and as a result, some regions have made this an injury prevention priority. It was reported in the PRQ that most regions have a dedicated IVP coordinator. Many regions have split this position to cover both administrative assistant support and injury and violence prevention. On further clarification, it was revealed that many of the regions do not have enough funding for both positions, forcing the regions to decide whether an administrative assistant position or the IVP position will be available. One full time position does not appear to be enough to complete both the administrative duties as well as injury prevention activities. The lead agency should complete a current assessment of the regional administrative assistant duties and injury prevention activity and work with the regions to bridge gaps in the ability to adequately support the needs of the regions. Corrective action plans may include alternate or creative ways of collaborating and delivering targeted injury prevention programs and may not necessarily be an increase in personnel. They may include improved or more efficient utilization of resources, strengthening partnerships with other agencies, and volunteerism.

There is no basic training available from the lead agency for those that are involved in IVP activity at the local and regional levels. As a result, the regional administrative assistants,

trauma hospital program managers, and other community partners do not have cost effective, local, basic training available to them. It would be beneficial to have entry level, intermediate and advanced injury prevention training programs available to all stakeholders in the trauma and EMS system. This basic training could be face-to-face or on-line. Harborview Injury Prevention and Research Center (HIPRC) has offered to create and deliver this training program. This is a good opportunity to create and/or strengthen IVP partnerships between the DOH, the trauma system leadership, public health, and other IVP organizations.

There is no annual report to inform the lay public and legislators on the trauma system and on injury and violence prevention activity. This annual report should be widely distributed to the general public, legislators, and trauma and EMS stakeholders.

There has been some media coverage specific to trauma such as pediatric falls from windows. DOH press release examples include EMS week and injury prevention strategies, distracted driving, safe swimming and water sports, and suicide prevention in teens. Social media activity is present. Examples include traumatic brain injury, falls, and available rehabilitation resources for trauma patients. Other non-trauma specific media coverage pertains to emergency medical services, cardiac, and stroke. The University of Washington has released injury prevention information via social media. Examples include car seat safety and concussion injuries in adolescents and teens.

Available injury and violence data are not current. The last update was 2013. There are insufficient resources available to obtain meaningful IVP data. The lead agency should develop strategies to share resources within the public health department to correct the data backlog and better support the needs of constituents that require data to drive their IVP efforts. If resources are unavailable, consider initiating partnerships with university schools of public health and the Harborview Injury Prevention Center.

The report titled “Safe States: An Assessment of the Washington State Injury and Violence Prevention Program” is an excellent comprehensive document. This assessment was conducted in 2014 by the Safe States Alliance. One of the recommendations from this assessment was to designate an “Injury and Violence Prevention Program Manager that specifically focuses on injury and violence prevention efforts full time.” Revisiting this recommendation and the other 27 remaining recommendations should occur. Every effort should be made to revitalize DOH EMS and Trauma IVP activity. The recommendations, after being updated, may also provide a good road map for strategic planning.

There appears to be superficial relationships between agencies doing violence prevention. The relationship between the lead agency and the Washington State Injury and Violence Prevention Program should be strengthened. The lead agency should develop ways of bringing partners together to strengthen relationships, pool resources, and share best practices for prevention programs.

Washington State has an “Injury and Violence Prevention Guide” dated January 2016. This guide is meant to be used by agencies, hospitals, and groups involved in injury prevention. It is a resource guide and toolkit that is data driven, evidence based, and functional. However, many trauma and EMS constituents were not aware of this document. The lead agency should initiate wide distribution of this document. The constituents from all organizations who are involved in IVP activities should review this document. It will assist them in moving their IVP activities forward.

Within the DOH, there is 0.5 FTE staff dedicated to injury and violence prevention. Originally, this was a full-time position, but due to budget constraints, it was decreased to 0.5 FTE. This is not enough bandwidth to adequately support statewide IVP activity. This contributes to the challenge of adequate lead agency oversight of EMS and Trauma injury prevention activity. The lead agency should dedicate one FTE to prevention activity.

Recommendations

- Identify key stakeholders in the state and strengthen partnerships for the delivery of data driven injury prevention programs.
    - Utilize existing resources, infrastructure, and expertise within the state, such as the Harborview Injury Prevention Center and schools of public health.
- Increase DOH EMS and Trauma IVP staff from 0.5 FTE to 1.0 FTE.
    - Expand this FTE's responsibilities to enable the lead agency to serve as a robust resource for agencies and trauma centers within the state; inform, educate, and deliver injury prevention education to local leaders.
- Create and implement a plan to routinely educate and inform the public and legislators on the status of injury prevention activities.
    - Integrate injury prevention and outreach activity into the annual trauma system report.
    - Implement contemporary media messaging processes and protocols (e.g. social media).
    - Develop a strategy in collaboration with the TAC and Regional TAC's to support timely media responses and messaging.
- Dedicate appropriate funding to support injury prevention personnel at the regional level.
- Create and widely distribute an injury prevention training module created by the lead agency that will help educate injury prevention coordinators, TPM's, and others on the basics of coordinating and leading injury prevention initiatives.
- Widely distribute the "Injury and Violence Prevention Guide" and other materials to support local injury prevention leaders.
- Create a web-based resource center for trauma centers and other agencies looking for injury prevention templates, programs, and educational materials.

Emergency Medical Services

Purpose and Rationale

The trauma system includes, and/or interacts with, many different agencies, institutions, and systems. The EMS system is one of the most important of these relationships. EMS is often the critical link between the injury-producing event and definitive care at a trauma center. Even though at its inception the EMS system was a very broad system concept, over time, EMS has come to be recognized as the prehospital care component of the larger emergency health care system. It is a complex system that not only transports patients, but also includes public access, communications, personnel, triage, data collection, and quality improvement activities.

The EMS system medical director must have statutory authority to develop protocols, oversee practice, and establish a means of ongoing quality assessment to ensure the optimal provision of prehospital care. If not the same individual, the EMS system medical director must work closely with the trauma system medical director to ensure that protocols and goals are mutually aligned. The EMS system medical director must also have ongoing interaction with EMS agency medical directors at local Levels, as well as the state EMS for Children program, to ensure that there is understanding of and compliance with trauma triage and destination protocols.

Ideally, a system should have some means of ensuring whether resources meet the needs of the population. To achieve this end, a resource and needs assessment evaluating the availability and geographic distribution of EMS personnel and physical resources is important to ensure a rapid and appropriate response. This assessment includes a detailed description of the distribution of ground ambulance and aeromedical locations across the Region. Resource allocations must be assessed on a periodic basis as needs dictate a redistribution of resources. In communities with full-time paid EMS agencies, ambulances should be positioned according to predictable geographic or temporal demands to optimize response efficiencies. Such positioning schemes require strong prehospital data collection systems that can track the location of occurrences over time. Periodic assessment of dispatch and transport times will also provide insight into whether resources are consistent with needs. Each Region should have objective criteria dictating the Level of response (advanced life support [ALS], basic life support [BLS]), the mode of transport, and the disposition of the patient based on the location of the incident and the severity of injury. A mechanism for case-based review of trauma patients that involves prehospital and hospital providers allows bidirectional information sharing and continuing education, ensuring that expectations are met at both ends. Ongoing review of triage and treatment decisions allows for continuing quality improvement of the triage and prehospital care protocols. A more detailed discussion of in-field (primary) triage criteria is provided in the section titled: System Coordination and Patient Flow (p 20) (White Book).

Human Resources

Periodic workforce assessments of EMS should be conducted to ensure adequate numbers and distribution of personnel. EMS, not unlike other health care professions, experiences shortages and maldistribution of personnel. Some means of addressing recruitment, retention, and engagement of qualified personnel should be a priority. It is critical that trauma system leaders work to ensure that prehospital care providers at all Levels attain and maintain competence in trauma care. Maintenance of competence should be ensured by requiring standards for

credentialing and certification and specifying continuing educational requirements for all prehospital personnel involved in trauma care. The core curricula for First Responder, Emergency Medical Technician (EMT) Basic, EMT-Intermediate, EMT Paramedic, and other Levels of prehospital personnel have an essential orientation to trauma care for all ages. However, trauma care knowledge and skills need to be continuously updated, refined, and expanded through targeted trauma care training such as Prehospital Trauma Life Support®, Basic Trauma Life Support®, and age-specific courses. Mechanisms for the periodic assessment of competence, educational needs, and education availability within the system should be incorporated into the trauma system plan.

Systems of excellence also encourage EMS providers to go beyond meeting state standards for agency licensure and to seek national accreditation. National accreditation standards exist for ground-based and air medical agencies, as well as for EMS educational programs. In some states, agency licensure requirements are waived or substantially simplified if the EMS agency maintains national accreditation.

EMS is the only component of the emergency health care and trauma system that depends on a large cadre of volunteers. In some states, substantially more than half of all EMS agencies are staffed by volunteers. These agencies typically serve rural areas and are essential to the provision of immediate care to trauma patients, in addition to provision of efficient transportation to the appropriate facility. In some smaller facilities, EMS personnel also become part of the emergency resuscitation team, augmenting hospital personnel. The trauma care system program should reach out to these volunteer agencies to help them achieve their vital role in the outcome of care of trauma patients. However, it must be noted that there is a delicate balance between expecting quality performance in these agencies and placing unrealistic demands on their response capacity. In many cases, it is better to ensure that there is an optimal BLS response available at all times rather than a sporadic or less timely response involving ALS personnel. Support to volunteer EMS systems may be in the form of quality improvement activities, training, clinical opportunities, and support to the system medical director.

Owing to the multidisciplinary nature of trauma system response to injury, conferences that include all Levels of providers (for example, prehospital personnel, nurses, and physicians) need to occur regularly with each Level of personnel respected for its role in the care and outcome of trauma patients. Communication with and respect for prehospital providers is particularly important, especially in rural areas where exposure to major trauma patients might be relatively rare.

Integration of EMS within the Trauma System

In addition to its critical role in the prehospital treatment and transportation of injured patients, EMS must also be engaged in assessment and integration functions that include the trauma system and also public health and other public safety agencies. EMS agencies should have a critical role in ensuring that communication systems are available and have sufficient redundancy so that trauma system stakeholders will be able to assess and act to limit death and disability at the single patient Level and at the population Level in the case of mass casualty incidents (MCIs). Enhanced 911 services and a central communication system for the EMS/trauma system to ensure field-to-facility bidirectional communications, inter-facility dialogue, and all-hazards response communications among all system participants are important for integrating a system’s response. Wireless communications capabilities, including automatic crash notification, hold great promise for quickly identifying trauma-producing events, thereby reducing delays in discovery and decreasing prehospital response intervals.

Further integration might be accomplished through the use of EMS data to help define high-risk geographic and demographic characteristics of injuries within a response area. EMS should assist with the identification of injury prevention program needs and in the delivery of prevention messages. EMS also serves a critical role in the development of all-hazards response plans and in the implementation of those plans during a crisis. This integration should be provided by the state and Regional trauma plan and overseen by the lead agency. EMS should participate through its leadership in all aspects of trauma system design, evaluation, and operation, including policy development, public education, and strategic planning.

Optimal Elements

I. The trauma system is supported by an EMS system that includes communications, medical oversight, prehospital triage, and transportation; the trauma system, EMS system, and public health agency are well integrated. **(B-302)**

a. There is well-defined trauma system medical oversight integrating the specialty needs of the trauma system with the medical oversight for the overall EMS system. **(I-302.1)**

b. There is a clearly defined, cooperative, and ongoing relationship between the trauma specialty physician leaders (for example, trauma medical director within each trauma center) and the EMS system medical director. **(I-302.2)**

c. There is clear-cut legal authority and responsibility for the EMS system medical director, including the authority to adopt protocols, to implement a performance improvement system, to restrict the practice of prehospital care providers, and to generally ensure medical appropriateness of the EMS system. **(I-302.3)**

d. The trauma system medical director is actively involved with the development, implementation, and ongoing evaluation of system dispatch protocols to ensure they are congruent with the trauma system design. These protocols include, but are not limited to, which resources to dispatch, for example, ALS versus BLS, air ground coordination, early notification of the trauma care facility, pre-arrival instructions, and other procedures necessary to ensure that resources dispatched are consistent with the needs of injured patients. **(I-302.4)**

e. The retrospective medical oversight of the EMS system for trauma triage, communications, treatment, and transport is closely coordinated with the established performance improvement processes of the trauma system. **(I-302.5)**

f. There is a universal access number for citizens to access the EMS/trauma system, with dispatch of appropriate medical resources. There is a central communication system for the EMS/trauma system to ensure field- to- facility bidirectional communications, inter-facility dialogue, and all-hazards response communications among all system participants. **(I-302.7)**

g. There are sufficient and well-coordinated transportation resources to ensure that EMS providers arrive at the scene promptly and expeditiously transport the patient to the correct hospital by the correct transportation mode. **(I-302.8)**

II. The lead trauma authority ensures a competent workforce. **(B-310)**

a. In cooperation with the prehospital certification and licensure authority, set guidelines for prehospital personnel for initial and ongoing trauma training, including trauma-specific courses and courses that are readily available throughout the state. **(I-310.1)**

b. In cooperation with the prehospital certification and licensure authority, ensure that prehospital personnel who routinely provide care to trauma patients have a current trauma training certificate, for example, Prehospital Trauma Life Support or Basic Trauma Life Support and others, or that trauma training needs are driven by the performance improvement process. **(I-310.2)**

c. Conduct at least 1 multidisciplinary trauma conference annually that encourages system and team approaches to trauma care. **(I-310.9)**

III. The lead agency acts to protect the public welfare by enforcing various laws, rules, and regulations as they pertain to the trauma system. **(B-311)**

a. Incentives are provided to individual agencies and institutions to seek state or nationally recognized accreditation in areas that will contribute to overall improvement across the trauma system, for example, Commission on Accreditation of Ambulance Services for prehospital agencies, Council on Allied Health Education Accreditation for training programs, and American College of Surgeons (ACS) verification for trauma facilities. **(I-311.6)**

Current Status

The state is fortunate to have several physicians with long standing involvement and investiture in the EMS system who have been very active for many years. Two private companies provide aeromedical service, both rotor and fixed wing, with good coverage throughout the state for transport of critical patients to trauma centers weather permitting. The state is fortunate to have an extremely high functional EMS service located in King County that is one of the oldest in the nation and a model nationwide. Other large cities, such as Bellingham and Spokane, also have progressive excellent EMS services with dedicated physician involvement. However, there is significant variability in EMS capabilities and response times across the state leading to health disparities depending on where one resides within the state.

Physician oversight of EMS rests in the Medical Program Director (MPD). There is one MPD designated per county. The lead agency limits the number of MPD's within the system, but a MPD can recruit additional physicians to help with education and online supervision. However, the final authority rests with the state designated MPD. As there are many agencies within each county, this can require an MPD to have oversight of an exceptionally large number of services. Best practices for MPD's, as illustrated in national policies, requires direct involvement and oversight of EMS personnel practice that simply is not possible with responsibility for a large number of services[1]. Responsibility for an excessive number of services is not conducive to functional oversight or effective quality improvement programs due to time constraints on a single MPD, as these are not full time positions. It is simply not possible for one physician to provide adequate oversight for a large number of services. It is also not optimal for a system to limit the number of MPDs involved from either a quality improvement or system performance perspective. Some states have actually specified the number of EMS agencies a physician may serve as medical director to ensure adequate physician oversight. For example, New York has stated a physician cannot serve as a medical director for more than 10 services[2]. It is not in the best interest of the state's EMS and trauma system to limit the number of MPDs.

The lead agency notes the difficulties of recruiting MPDs, particularly in more rural areas of the state, as well as the need for succession planning. Currently, the lead agency does not provide any real resources to MPDs. The lead agency notes that it provides education to MPDs. However, discussions with stakeholder MPDs note that there is no initial or recurrent training provided. They also could not identify any other resources available to them in their role. This should be a state requirement and lead agency responsibility to ensure its MPD workforce is current in state regulation and EMS best practices and is provided the necessary tools to function in their roles. It should be noted that there is no identified state EMS Medical Director. Creating such a position within the lead agency could help coordinate initial and ongoing educational activities for MPDs as well as serve as a valuable resource in assisting them in creating protocols and effective PI activities. According to a survey conducted by the National Association of State EMS Officials (NASEMSO) conducted in 2007, over 80% of states had an identified state medical director at that time[3]. It is likely that additional states have created such a position since that survey. The lead agency is strongly encouraged to follow national trends and create such a position.

The lead agency should incentivize additional MPD participation within the system. This can be done in a number of creative ways, besides providing actual stipends, such as providing reduction in licensing fees for MPD's or providing online educational resources, periodic face-to-face free CME related to medical direction, or medical direction manuals. Some states provide perks for volunteer EMS personnel, such as a reduction in county property or personal vehicle taxes or free license plate renewals, to incentivize continued volunteerism. In these situations, extending such perks to volunteer medical directors has been useful to recruit and maintain medical directors in other states. The lead agency is also encouraged to query NASEMSO regarding additional potential incentives that could be used to help recruit MPDs. In addition, allowing the expansion of MPDs would assist in creating a mentorship program and serve as succession planning for others leaving the system. The lead agency should actively recruit additional MPDs by partnering with the state medical societies, particularly the state Chapters of ACEP and ACS, as well as the medical licensing section of the DOH. Offering additional incentives as the examples previously mentioned has worked well in other venues to recruit additional volunteer physicians into the system.

It is noted that the lead agency specifically asked for guidance with respect to the evaluation of the effectiveness and efficiency of EMS processes and impact of variance across the state. It is noted that Washington State has statewide EMS protocols, but these are not current and have not been revised since 1996. The state also has a coordinated quality improvement program, which promotes and approves plans statewide that are at this point exclusively health institution specific. Although there is a list of EMS performance indicators, there do not appear to be any ongoing statewide EMS quality improvement activities. EMS quality improvement activities primarily occur at the local level with little involvement of trauma system medical directors. The lead agency should coordinate statewide integrated trauma, MPD, and EMS quality improvement activities focused on the prehospital component of care. This could then be reviewed by the EMS and Trauma Care Steering Committee and used to make system improvement efforts. Similar joint trauma, MPD, and EMS quality improvement activities should occur at the regional level, as well, focused on regional improvement efforts. Having a designated EMS State Medical Director would allow for direct physician oversight and statewide coordination of medical direction, EMS protocol revisions, and performance improvement activities tied to overarching statewide system improvement and desired patient outcomes.

Ground and air EMS agencies are licensed by the lead agency with detailed training and equipment requirements. However, no requirements exist for critical care services. There are

two private ground critical care services currently operating in the state. The lead agency should create and promulgate staff training and equipment requirements for critical care services. There are a number of best practices and guidelines available nationally to assist in this endeavor[4,5]. Again, it is also noted that an EMS Medical Director position within the lead agency would be a significant asset in addressing this need.

The lead agency recently contracted to create the WEMSIS electronic database system for EMS patient care reporting. This system is currently not well integrated into the trauma registry, but integration efforts are ongoing. There is no requirement for EMS to use the system and many are not doing so. Some EMS agencies are still using paper reporting. The lack of a standardized required electronic patient care database significantly hampers loop closure and quality improvement efforts. Additionally, trauma centers have difficulty getting EMS patient care reports. The lead agency should mandate EMS utilization of WEMSIS to standardize data collection and promote system quality improvement activities.

EMS agencies are a blend of private fee-for-service entities, and volunteer agencies. They range in capability from large urban fire-based to rural all volunteer. EMS agencies are largely funded by voluntary tax levies at the county level. EMS funding often needs to be renewed annually by levy vote. There is essentially no other outside funding for EMS other than patient billings. Some smaller counties have rejected the EMS levy and thus financial ability of the local EMS service to obtain new or updated equipment or additional training is impacted. In general, EMS is underfunded throughout the state.

It was reported that a percentage (2.9%) of the biennium 2019-2020 trauma fund spending plan is ear-marked for EMS. This level of financial support allocated for EMS is a very small portion of the available funds, which is relatively low and seems insufficient to meet the needs of the system, especially for the more rural and volunteer EMS services. Of note, stakeholders reported that virtually no state funds have been provided directly to support EMS agencies in the past several years, and that the vast majority of funding for EMS is local as previously noted. It was also noted that the lead agency provides biannual EMS grants, which reportedly provided $1,266.00 per agency that applied in 2019, but not all agencies apply or have the infrastructure to do so. The lead agency should provide additional financial resources for all EMS agencies, which would be helpful particularly in rural areas, to ensure that the EMS workforce is adequately trained and equipped to provide optimal patient care.

The number of EMS agencies has historically been determined based on a min/max number that is set and controlled at the regional council level. This methodology has not changed since the trauma system’s inception and seems to be based on historical convention rather than on population based indicators. Currently, health care disparities exist across the state, particularly in less populated areas, with respect to EMS response times and level of care. Reconsideration of the use of this methodology may help reduce such disparities. There are no national criteria for using this type of methodology to determine EMS agency numbers. Specifically, maximum numbers are not considered in determining the need for EMS assets. System response data is the national benchmark that should be used as the driver for decisions, and not maximum numbers. Calculations of number of EMS systems needed in a specific area should take into account population density, call volume, desired response times and other general well established principles of system status management, which can be continually adjusted as population grows or other factors change. For example, if EMS response times are outside of generally acceptable ranges, adding additional systems to better align response times to acceptable standards should be done even if it exceeds the max number allowable[6,7,8]. In addition, using hard maximal numbers could have unintended consequences in that it may

potentially be used for individual benefit to prevent competition within an area rather than making decisions based on patient care needs and access.

The system status management and performance measures, including fractile response indicators which are the nationally accepted standard, should be used to calculate and benchmark the ideal number of EMS assets within a system. References provided at the end of this document, and referenced in the body at the end of appropriate sentences, should assist the lead agency in determining the minimum number of EMS agencies throughout the state necessary to meet nationally established benchmarks and EMS performance measures. This would reduce health disparities across the state with respect to access to EMS services.

The number of EMS assets in the trauma system is not sufficient. The current system requires EMS services to be verified as trauma capable to be dispatched for trauma response. Not all agencies have this designation, and thus, response times for trauma patients can be quite variable. This is particularly prevalent outside of urban areas. Currently, EMS expected response times are adjusted accordingly depending on where in the state the EMS service is: 10 minutes response time for urban areas, 20 minutes for suburban areas, and 45 minutes for rural environments. Since response time and the time to initial treatment is a significant factor in final patient outcomes (the Golden Hour begins at the time of injury), the lead agency should ensure that trauma capable EMS agencies are available to all citizens in a timely fashion. There are national standards with generally accepted audit criteria definitions which the lead agency is encouraged to use to benchmark the performance of EMS services within the state[9,10]. This could assist the lead agency in determining where there are significant gaps in the EMS system coverage in terms of number of units or response capabilities. Although some disparities will always exist between urban and rural areas, response time from receipt of the 911 call should be no more than 25 minutes in trauma cases, as well as other time sensitive conditions such as stroke and cardiac. There are published national standards in this regard[11].

Encouragement and assistance in getting all currently licensed EMS agencies to the level of trauma verified designation should occur. Recruitment of additional agencies where gaps exist should also occur. A critical system asset is PSAPs. These are currently outside of the EMS and Trauma system, and are part of the military health system. This disconnect hampers the ability to ensure that proper dispatching of EMS agencies is occurring for trauma response. The lead agency should facilitate linkages between MPD's and PSAP leadership to ensure that system quality improvement activities can occur.

There are sufficient air medical resources throughout the state. However, due to weather conditions, they may not have availability a significant portion of the time. Inter-facility transports of trauma patients when air is not available occur by ground. However, there is a paucity of critical care capable ground services in the state, and thus by necessity, inter-facility ground transports between hospitals are frequently done with nurses and/or respiratory therapists added to existing local ALS ground units. This is suboptimal, as these personnel are not familiar with the prehospital environment, equipment, or protocols. The lead agency should work to create and promulgate standards for critical care ground transport agencies and to increase their availability statewide.

The lead agency does have trauma destination protocols, which are modified and operationalized at the regional council level. However, individual EMS agencies do not follow them, and each EMS provider reportedly makes destination decisions based on his or her knowledge and experience. There is not an optimal way for trauma centers or MPD's to ensure that trauma destination protocols are actually being followed. In part, this is due to inconsistent

use of the WEMSIS system. Mandated use of trauma destination protocols and WEMSIS systems would help ensure standardization and destination protocols are being followed.

Recommendations

- **Mandate that all EMS agencies submit data into the WEMSIS system, and develop data linkages with the trauma registry.**
- **Ensure trauma destination protocols are consistently followed by EMS agencies.**
- **Establish an objective and standardized statewide process to revise the Minimum and Maximum criteria for the number of EMS agencies in the system.**
- Ensure trauma and EMS quality improvement efforts are occurring.
- Ensure all EMS response agencies meet the criteria to be trauma verified services.
- Develop requirements for equipment, personnel credentials and training, and designation for critical care ground transport agencies.
- Provide consistent financial support for EMS agency growth, such as block grants and subsidized training programs.
- Incentivize additional physician engagement as Medical Program Directors to ensure there is sufficient oversight of EMS agencies.
- Provide ongoing Medical Program Director education to remain current with state requirements, for process improvement efforts and loop closure, and to support EMS system growth.

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Definitive Care Facilities

Purpose and Rationale

Inclusive trauma systems are the systems that include all acute health care facilities, to the extent that their resources and capabilities allow and in which the patient's needs are matched to hospital resources and capabilities. Thus, as the core of a Regional trauma system, acute care facilities operating within an inclusive trauma system provide definitive care to the entire spectrum of patients with traumatic injuries. Acute care facilities must be well integrated into the continuum of care, including prevention and rehabilitation, and operate as part of a network of trauma-receiving hospitals within the public health framework. All acute care facilities should participate in the essential activities of a trauma system, including performance improvement, data submission to state or Regional registries, representation on Regional trauma advisory committees, and mutual operational agreements with other Regional hospitals to address inter-facility transfer, educational support, and outreach. The roles of all definitive care facilities, including specialty hospitals (for example, pediatric, burn, severe traumatic brain injury [TBI], spinal cord injury [SCI]) within the system should be clearly outlined in the Regional trauma plan and monitored by the lead agency. Facilities providing the highest Level of trauma care are expected to provide leadership in education, outreach, patient care, and research and to participate in the design, development, evaluation, and operation of the Regional trauma system.

In an inclusive system, patients should be triaged to the appropriate facility based on their needs and facility resources. Patients with the least severe injuries might be cared for at appropriately designated facilities within their community, whereas the most severe should be triaged to a Level I or II trauma center. In rural and frontier systems, smaller facilities must be ready to resuscitate and initiate treatment of the major injuries and have a system in place that will allow for the fastest, safest transfer to a higher Level of care.

Trauma receiving facilities providing definitive care to patients with other than minor injuries must be specifically designated by the state or Regional lead agency and equipped and qualified to do so at a Level commensurate with injury severity. To assess and ensure that injury type and severity are matched to the qualifications of the facilities and personnel providing definitive care, the lead agency should have a process in place that reviews and verifies the qualifications of a particular facility according to a specific set of resource and quality standards. This criteria-based process for review and verification should be consistent with national standards and be conducted on a periodic cycle as determined by the lead agency. When centers do not meet set standards, there should be a process for suspension, probation, revocation, or de-designation.

Designation by the lead agency should be restricted to facilities meeting criteria or statewide resource and quality standards and based on patient care needs of the Regional trauma system. There should be a well-defined regulatory relationship between the lead agency and designated trauma facilities in the form of a contract, guidelines, or memorandum of understanding. This legally binding document should define the relationships, roles, and responsibilities between the lead agency and the medical leadership from each designated trauma facility.

The number of trauma centers by Level of designation and location of acute care facilities must be periodically assessed by the lead agency with respect to patient care needs and timely access to definitive trauma care. There should be a process in place for augmenting and restricting, if necessary, the number and/or Level of acute care facilities based on these periodic assessments. The trauma system plan should address means for improving acute care facility participation in the trauma system, particularly in systems in which there has been difficulty addressing needs.

Human Resources

The ability to deliver high-quality trauma care is highly dependent on the availability of skilled human resources. Therefore, it is critical to assess the availability and educational needs of providers on a periodic basis. Because availability, particularly of subspecialty resources, is often limited, some means of addressing recruitment, retention, and engagement of qualified personnel should be a priority. Periodic workforce assessments should be conducted. Maintenance of competence should be ensured by requiring standards for credentialing and certification and specifying continuing educational requirements for physicians and nurses providing care to trauma patients. Mechanisms for the periodic assessment of ancillary and subspecialty competence, educational needs, and availability within the system for all designated facilities should be incorporated into the trauma system plan. The lead trauma centers in rural areas will need to consider teleconferencing and telemedicine to assist smaller facilities in providing education on regionally identified needs. In addition, lead trauma centers within the Region should assist in meeting educational needs while fostering a team approach to care through annual educational multidisciplinary trauma conferences. These activities will do much to foster a sense of teamwork and a functionally inclusive system.

Integration of Designated Trauma Facilities within the Trauma System

Designated trauma facilities must be well integrated into all other facets of an organized system of trauma care, including public health systems and injury surveillance, prevention, EMS and prehospital care, disaster preparedness, rehabilitation, and system performance improvement. This integration should be provided by the state and/or Regional trauma plan and overseen by the lead agency.

Each designated acute care facility should participate, through its trauma program leadership, in all aspects of trauma system design, evaluation, and operation. This participation should include policy and legislative development, legislative and public education, and strategic planning. In addition, the trauma program and subspecialty leaders should provide direction and oversight to the development, implementation, and monitoring of integrated protocols for patient care used throughout the system (for example, TBI guidelines used by prehospital providers and non-designated transferring centers), including Region specific primary (field) and secondary (early transfer) triage protocols. The highest Level trauma facilities should provide leadership of the Regional trauma committees through their trauma program medical leadership. These medical leaders, through their activities on these committees, can assist the lead agency and help ensure that deficiencies in the quality of care within the system, relative to national standards, are recognized and corrected. Educational outreach by these higher Levels centers should be used when appropriate to help achieve this goal.

Optimal Elements

I. Acute care facilities are integrated into a resource efficient, inclusive network that meets required standards and that provides optimal care for all injured patients. **(B-303)**

- **a.** The trauma system plan has clearly defined the roles and responsibilities of all acute care facilities treating trauma and of facilities that provide care to specialty populations (for example, burn, pediatric, SCI, and others). **(I-303.1)**

II. To maintain its state, Regional, or local designation, each hospital will continually work to improve the trauma care as measured by patient outcomes. **(B-307)**

- **a.** The trauma system engages in regular evaluation of all licensed acute care facilities that provide trauma care to trauma patients and of designated trauma hospitals. Such evaluation involves independent external reviews. **(I-307.1)**

III. The lead trauma authority ensures a competent workforce. **(B-310)**

- **a.** As part of the established standards, set appropriate Levels of trauma training for nursing personnel who routinely care for trauma patients in acute care facilities. **(I-310.3)**

- **b.** Ensure that appropriate, approved trauma training courses are provided for nursing personnel on a regular basis. **(I-310.4)**

- **c.** In cooperation with the nursing licensure authority, ensure that all nursing personnel who routinely provide care to trauma patients have a trauma training certificate (for example, Advanced Trauma Care for Nurses, Trauma Nursing Core Course, or any national or state trauma nurse verification course). As an alternative after initial trauma course completion, training can be driven by the performance improvement process. **(I-310.5)**

- **d.** In cooperation with the physician licensure authority, ensure that physicians who routinely provide care to trauma patients have a current trauma training certificate of completion, for example, Advanced Trauma Life Support® (ATLS®) and others. As an alternative, physicians may maintain trauma competence through continuing medical education programs after initial ATLS completion. **(I-310.8)**

- **e.** Conduct at least 1 multidisciplinary trauma conference annually that encourages system and team approaches to trauma care. **(I-310.9)**

- **f.** As new protocols and treatment approaches are instituted within the system, structured mechanisms are in place to inform all personnel about the changes in a timely manner. **(I-310-10)**

Current Status

The State of Washington has a long-established process that designates trauma centers from Level I to Level V, based on state-specific standards that are derived from and consistent with national standards developed by the American College of Surgeons Committee on Trauma. The system intends for a Level I center to be a regional referral resource, with ability to care for the full spectrum of complex cases, including highly regionalized services such as re-implantation, complex neurosurgical, and complex orthopaedic care. Consistent with this vision,

the single Level I center is a high volume facility, with a strong national reputation for teaching and research, and strong clinical outcomes based on both local and national data. Level II centers are expected to provide an equivalent level of clinical care for the majority of patients not requiring highly specialized services. Experience relayed by the trauma system stakeholders supports this function, with relatively few transfers from Level II centers to the Level I center reported. The differences in published standards between Level I and Level II centers are relatively minor, and focus on somewhat shorter response times for specific provider groups (e.g. a 5 minute response time for anesthesia or neurosurgery at a Level I center versus a 15-30 minute response time for these services in a Level II center). Level III centers generally provide full-time general surgical services, with slightly longer response times than Level I or Level II centers, but generally do not provide full-time neurosurgical coverage. Levels IV and V centers primarily represent system entry points for evaluation and immediate stabilization, without full-time surgical coverage. Designation at Levels I through III requires a site visit by external reviewers, while designation at levels IV and V does not require such review. All designations are re-evaluated on a three-year cycle. This process has been efficiently run in the state since the 1990's.

The State currently provides funding to all providers in the continuum of trauma care: prehospital, acute care services, trauma team physicians, and rehabilitation services. Designated trauma centers receive pass through funding to support both readiness and for the provision of unfunded or underfunded care as well as trauma supplemental Medicaid payments. The distribution plan first divides the available funds into buckets for either trauma Medicaid claims match versus pass through funding (grants). The Medicaid buckets are then split between Level I-III designated services and trauma team physicians. The pass through funding is split into buckets for each type of provider: EMS, acute care, and rehabilitation care. Those buckets are then further split into allotments for different pass through methodology types: participation for readiness costs and trauma care for uncompensated or undercompensated care. Each pass through calculation methodology uses different data and methods to determine the per provider amount. For acute care service participation pass through, the largest percentage goes to Level I centers, the second highest to Level II centers, and so on down through Level V and is weighted by patient volume and service location (rural, suburban, urban) with different weights for pediatric services. This plan acknowledges the higher costs for top-level centers, but by its nature, the addition of a center at a given level will decrease the funds available to other centers at that level. This potentially dis-incentivizes system growth, as centers at a given level may be inclined to resist addition of new centers at that level on a financial basis rather than on the system need.

There is also a process in place that is intended to ensure that trauma centers are designated in response to assessed need, with the goal to avoid unnecessary duplication of costly resources. The Level I designation is categorized as a state level function, and the maximum number of Level I trauma centers has been fixed at one since the inception of the system (DOH 689-163). Each region is charged with establishing a minimum number and a maximum number of trauma centers at each level from II-V. There is general guidance regarding the factors that should influence the choice of minimum/maximum (min/max) numbers, but there is no set process and there are no suggested benchmarks to guide this process. There is no evidence that the state-level minimum/maximum of one Level I center was established based on objective data, and there has not been a formal re-assessment of this decision. Similarly, there is no evidence that the original min/max levels for each region were set based on objective data, and most have not been modified since originally established in the 1990's. There are a few examples of regions evaluating the min/max numbers, with one case in the Central Region involving a data-driven argument based on in-depth analysis of registry data, but there has been no systematic review

conducted by the regions as originally conceived in the trauma plan. Further, most regions lack the resources and expertise to conduct the sort of data-driven analysis that is outlined by state guidelines.

The number and distribution of designated centers has largely remained static for many years. A majority of acute care facilities are designated at levels I to V (a total of 82). The Level I and Level II facilities are primarily located along the I-5 corridor in the western part of the state, along with the Spokane area in the east, and one along the south-western border. The role of Level III-V centers in the state is somewhat dichotomous. Those located in more rural areas of the state serve a critical function as entry points to the system in areas remote from a Level I or Level II center. However, a substantial number of these centers operate within 60 minutes of a Level I or Level II center, and their role is less well-defined. The lead agency and the stakeholders report that the system is based on an inclusive model, which appears to mean that any hospital wishing to participate will be designated at an appropriate level, and over 80% of acute care facilities do participate as designated trauma centers. It is worthy of note that the definition of an inclusive system envisioned in the 2006 *Model Trauma Systems Evaluation and Planning* document (see Appendix B), and as utilized by the Trauma Systems Consultation Program, defines an inclusive system as one in which all acute care facilities have a defined role (including data reporting requirements) in the care of injured patients, whether or not they are designated as trauma centers. This model specifically does not require that all acute care facilities be designated as trauma centers. From this point of view, there are about 20 undesignated facilities (most in the Seattle metropolitan area) that are not currently a part of the system, and have no formal role or requirements, though they do provide care for injured patients. Trauma designation is voluntary in Washington State. Facilities apply to be trauma designated and the minimum/maximum informs if there is a need for it in that region. Trauma designated facilities have to meet the trauma designation standards. The undesignated facilities do not have to meet any standards with respect to the care of injured patients, and are not generally EMS destinations for acutely injured patients. Analysis of discharge data in the Central Region suggests that the undesignated facilities see a substantial number of patients with minor injuries (about 2/3 the number seen at the Level III-V facilities in the region) with similar calculated ISS. This suggests that some basic standards regarding data collection and injury management be established for all acute care facilities, whether or not they are designated trauma centers.

Geographic and population coverage of the state is generally good, as the distribution of trauma centers is well-matched to the population density of the state. Simple geospatial (GIS-based) analysis suggests that about 76% of the state's population and 12% of area are within 60 minutes from point of injury to a Level I or Level II center by ground (*Figure 1*), and 96% of the population and 57% of the area is within 60 minutes by ground of any designated trauma center (*Figure 2*). The less-populous areas in the central portion of the state present significant challenges for transportation resources, due to lack of proximity to Level I or Level II centers.

The system appears to work well as an inter-connected network of centers. Stakeholders from smaller hospitals reported few problems with the willingness of higher-level centers to accept patients, though there were some instances in which bed capacity at Level II centers limited the ability to accept transfers and resulted in longer distance transfer to another accepting facility.

The state has eight designated pediatric trauma centers: one Level I, two Level II's, and five Level III's. The distribution pattern parallels that of the adult centers, with the high-level resources along the eastern and western borders of the state, with less coverage in central regions. Stakeholders felt that ability to gain appropriate access to pediatric centers was good.

There is a single verified burn center located at the Level I trauma facility and most major burns in the state are transferred to this facility. The burn patients in the southwest part of the state are transferred to the Legacy Oregon Burn Center in Portland, Oregon.

Focused Analysis

The review team was specifically requested to examine several elements of the system related to the design of the system and the designation of trauma centers, and to provide recommendations regarding objective metrics to assist in the determination of regional min/max numbers. It must first be stated that there are no nationally accepted standards regarding the number, level, or distribution of trauma centers within a system. There are likewise no nationally accepted or validated metrics of trauma system or trauma center performance. Further, there are a number of critical design decisions that require policy-based trade-offs. These are inherently specific to a given region and inherently political. Examples of this sort of decision include the balance between centralization to a few high-volume centers or load distribution to a larger number of smaller centers; the role of level III-IV trauma centers in urban/suburban settings; and the balance between local care close to the patient's home and longer transport to distant centers.

Very few states or regions have specific regulations related to determining the number and location of trauma centers by objective criteria, and none are strongly evidence-based. Washington's current approach is one of the most detailed, and bears similarity to the approach utilized in Pennsylvania and to that used in the original design of the Florida system. See appendix E for related resources. The Florida system was a source of intense controversy over the past several years, engendering protracted legal battles. This debate led to the adoption of a very specific, though not evidence-based, approach that was subsequently adapted by the ACS COT as the basis for its initial work on the Needs Based Assessment of Trauma Systems (NBATS) process. This system relied primarily on base population coverage and transport time, while utilizing several other factors derived from prior academic thought and local politics, and aimed to assign a specific number of trauma centers to a region. The approach was briefly adopted in Florida law, but has subsequently been repealed. The approach has been tested in several regions as part of the NBATS project, and the predictions were found to depend almost entirely upon its population-based scoring elements. The approach tended to overestimate the number of trauma centers in rural regions, and underestimate the number found in urban and suburban regions as compared to the existing distribution, but there is no experience that validates the number of centers predicted by such a tool as the true ideal. There is fairly extensive literature on the use of various geospatial approaches to generate optimized system configurations. These approaches can optimize various parameters, also based upon volume and transportation time, but suffer from the same ultimate limitation; there is no data that validates such "optimized" configurations as the best operational solution. These observations have led the ACS COT to re-evaluate the NBATS process, with the central assumption, summarized above, that trauma system configuration inherently relies on policy-based trade-offs, and that objective metrics are best utilized to provide a basis to help choose between various options, rather than to define a single best configuration[11]. A list of references is attached in Appendix E.

Washington has a unique vision of the role of the Level I center, and is the only state of its size to have specifically limited the role to a single facility. This appears to be deeply rooted in the origins of the Washington State System, which developed largely out of the approach to EMS and trauma care that arose from the Seattle area, combined with the unique cultural and resource-based characteristics of the current Level I center. The historical model consisting of a

single Level I center, based on a public safety net hospital, can still be found in a few large cities, but has generally disappeared as the economics of healthcare have forced most cities to abandon the public hospital model in favor of a network of private institutions. It is now much more common to find a network of Level I and Level II centers, with the differentiation between levels based on functional characteristics and educational mission, but with the general understanding that clinical care delivery is equivalent in all but the most specialized cases. Both models have advantages and disadvantages, and the decision between them is one of policy, not objective science.

The ACS Review Team was specifically asked to address the question of whether “Washington needs more Level I centers”. The answer depends upon what role a Level I center is intended to play in the Washington system. There is little doubt that the enhancement of clinical services at Level II centers in the eastern or southwestern parts of the state (areas that are remote from the existing Level I center) would improve care for the citizens in those regions, and the existing level II centers should be encouraged to work on building their capacity. In so doing, these centers might fulfill the state requirements for Level I designation. At an operational level, designation of an additional Level I center at the opposite end of the state would have no meaningful impact on the clinical operations at the current Level I center. Under the current financial model, designation of additional Level I centers could have a significant adverse financial impact on the existing Level I center. Because of this unintended consequence of the financial model, it is impossible to separate potential clinical benefits of increased system capacity from adverse financial effects on existing centers, a problem not limited to Level I centers. That said, there is no clear clinical need for additional Level I resources per se, based on the minimal differences between criteria for Level I and Level II centers, and the intended clinical equivalence of Level I and Level II centers. In essence, the policy establishing a single Level I center in the state (DOH 689-163) serves as a de-facto mechanism to ensure adequate funding for the current Level I center.

It is the opinion of the consultation team that the clinical mission of the system can continue to be well-met without the need to designate additional Level I centers, and that incentives for hospitals to continue to serve as trauma centers, or increase their level of function can be provided in other ways. On the other hand, the development of additional high-level trauma center capacity within the state will improve surge capacity and system resilience, and may aid with load balancing in times of increased demand. In this light, designation of additional Level I centers offers a way to provide additional funds to these centers to improve readiness and enhance system capability. The key enabling step would be to re-define the financial distribution model to remove the current dependence of financial support on the number of centers at a given level.

Ultimately, the decision to continue the current model, which has worked well over many years, or to re-envision the Level I role in the system is one that should be made as part of the collective vision for the future of the Washington system. Alternate methods of supporting readiness costs for high-functioning Level II centers could be sought without the need for re-designation. Whichever direction the system elects, the role requirements for Level I centers and the rationale and data behind the min/max decisions should be well documented and clear in order to stand up against any potential future challenge from a center desiring Level I status.

For more detailed analysis of trauma center access, the State provided trauma registry data for a 2 year period (2016-2017) for patients transported directly from the scene of injury, including destination hospital, mode of transport, transport time, along with triage indicators and markers of injury severity. This data set included 70,699 individual records, of which 47,364 were scene

transports with data on ZIP code of injury. This data allows only limited precision with respect to geo-localization of injury, and is much cruder in rural areas in which a single ZIP code encompasses a much larger land area. Of these, 29, 599 (62%) also had information on transport times that fell in the range of 1 to 360 minutes. Longer or shorter times were felt most likely to represent data entry errors. Analysis of transport times > 60 minutes was done, and a hot-spot map created (*Figure 3*). Of interest, the majority of geocoded runs with transport times over 60 minutes occurred within the estimated 60 minute coverage area of existing high-level centers, but there were also specific areas in the more rural parts of the state with a higher concentration of long transport times. This analysis is confounded by incomplete overall availability of both geo-localizing data and transport time data, an effect that is likely worse in more rural areas. Further, as data was derived from trauma registry entries, the quality of data may be dependent upon the specific capabilities of the registry team at each individual location, leading to potential reporting bias.

Looking both at geospatial analysis using publicly available data, and at the registry data that could be geo-coded, addition of a Level II center in the central area of the state would improve population coverage and shorten transport times for a subset of patients, likely without significant clinical impact on existing centers. Geospatial modelling allows the testing of various hypothetical system configurations to determine the effects and select the optimal solution based on objective estimates of population coverage and transport times. For example, addition of a Level II center in Yakima (*Figure 4*) would result in an increase in population coverage of about 260,000 (4%) and an increase in geographic area of about 1,700 square miles (2%). Registry data reports 182 trauma cases occurred within the estimated coverage of a center in Yakima (*Figure 5*). The same analysis estimates that addition of a Level II center in Wenatchee (*Figure 6*) would result in an increase in population coverage of about 88,000 (1%) and an increase in geographic area of about 1000 square miles (1%). Registry data reports 936 trauma cases occurred within the estimated coverage of a center in Wenatchee (*Figure 7*). As noted above, the difference in number of injured patients derived from the registry must be interpreted with caution based on the relatively small number of cases in the registry with data on location of injury.

This analysis suggests that designation of a Level II center at either location would provide improved access for patients within the region served, and decrease long-distance transfers without substantial impact on remote centers. Further, it appears that there would be little direct interference between these centers if both were designated at Level II. Data of this nature allows for an assessment of the relative impact of such designation choices; however, the best choice among the available options remains a matter of policy and practicality, and cannot be definitively calculated from existing data alone.

The basis of a process to estimate min/max numbers for high-level (Level I and Level II) trauma centers has been fairly well established through existing practices in various parts of the US, but there is no consensus on specific benchmarks. There is no applicable peer-reviewed literature to support any specific method. Currently, specific rules regarding need-based designation exist in only a few states, and are not uniform or comprehensive. In the vast majority of cases, the number and location of high-level trauma centers is determined by market forces and historical practice patterns. The configuration of the “optimum” system is inherently specific to each region, and is driven in large part by government policy and local practice. There are no globally applicable standards and no single right answer, hence needs assessment must be understood as a process to inform local policy decisions and not as a simple optimized solution derived from a universal template. Decisions regarding optimal system configuration must ultimately be made by the lead agency and local stakeholders, taking both global principles and local resources,

data, experience, and attitudes into account. Working from this understanding, the analysis that follows offers a methodology to benchmark system design against existing practice within the US, as this is the only data-based metric available. Existing national experience does not imply best practice, and these data have no connection to clinical outcomes. Thus, the analysis does not and cannot provide a definitive answer regarding trauma center need, nor does it imply that such data should drive local decisions in isolation. The approach does provide an external reference to assess how a current configuration or a potential new configuration compares to the structure and function of other trauma systems in the US.

It is generally accepted that a high-level center must treat a minimum number of injured patients to justify resource expenditure and to maintain institutional experience. There is data to suggest that high-volume centers may have better outcomes than low volume centers, but this data is inconsistent, and its interpretation is controversial. Volume requirements for high-level trauma centers are most often expressed in terms of raw population coverage, which is more easily calculated, or in terms of number of injured patients in the region, which is more difficult to assess. Across US trauma systems, the population served by a single high-level center most commonly lies between about 250,000 to 1,000,000, with a few systems in which the value is significantly higher. Lower population coverage per center is seen in systems that favor flexibility and surge capacity, with higher population coverage per center favored by those that feel care is improved at high-volume centers, and in regions that are served by well-established high-volume centers. It must be re-stated that in almost all cases the actual number of trauma centers in a region within the US is operationally determined by market forces. The choice of necessary population base is the most objective and reproducible method to set minimum and maximum numbers of high-level centers in a region. Metrics of system access, such as geographic coverage and transportation times can be used to add specificity to the choice of optimal geographic location, and to fine-tune population-based estimates.

The estimation of need for trauma center capacity is further complicated by the fact that high-level trauma centers vary substantially in hospital size and annual volume, with a range from under 1,000 to over 7,000 patients per year, and a median of about 2,000 patients per year, based on data from the National Trauma Data Bank for the year 2015. Normalizing for hospital size, the median center admitted 372 trauma patients per 100 beds, with a range from under 50/100 beds to over 2,600/100 beds. Thus, a system to care for 7,000 trauma patients could conceivably be designed with one large center, two or three intermediate ones, or an even larger number of smaller ones. Each configuration choice has its own advantages and disadvantages, and must be determined by local system policy and resource availability. There are no available standards regarding optimal trauma center size or capacity. By way of comparison, the existing Level I center in Washington sees roughly 1,700 trauma patients per 100 beds (which is among the highest of all US Level I centers) while the majority of Level II centers see roughly 350 - 400 trauma patients per 100 beds (which is near the median value for US centers). Two of the Level II centers see a lower normalized volume of about 100 – 150/100 beds (which is in the lowest quartile among US centers).

Ultimately, adding specificity to estimates of population coverage, frequency of injury, or the optimal size and capacity of trauma centers still cannot provide definitive estimates of trauma center need, as these detailed calculations currently lack strong connection to objective measures of patient outcome and are outweighed by policy-based decisions around what constitutes sufficient coverage and access. Given these limitations, the consultation team recommends continuation of the current Washington approach of providing a minimum and maximum number of high-level centers based on regional synthesis of available data, public sentiment, and government policy. The consultation team further recommends utilizing

population coverage as the primary metric of need for high-level trauma centers. The simplest external benchmark would be to utilize national experience to establish the range (i.e. from a minimum of one high-level trauma center per 1,000,000 population to a maximum of one high-level trauma center per 250,000 population). This methodology does not account for differences in trauma center size or capacity. An alternative approach, proposed by the Trauma Systems Committee as an improvement to a simple population-based benchmark but not validated in practice, involves estimation of need based upon the national experience (from NTDB data) regarding trauma center capacity per 100 beds, using the 25th and 75th percentile to define minimum and maximum number of trauma center beds required in a region. The number of trauma centers is then determined by hospital size and target capacity level needed to service the estimated volume of trauma center admissions. A sample calculation using each method is provided in Appendix F.

In order to refine the benchmarking process, it would be possible to modify these approaches to adjust to Washington-specific population coverage ranges or Washington-specific trauma center capacity ranges. It would also be possible to utilize the injury frequency estimated from the trauma registry as an additional base metric, but there are as yet no accepted national standards, so it is uncertain that this additional complexity brings any additional precision to the min/max estimations.

This approach is currently limited to centers that are ultimate transfer destinations capable of providing definitive care. In Washington, this will include all Level I and Level II centers, and in some regions may include Level III centers as well, depending on how these centers interact with existing Level I and Level II centers. There is wide variability in the utilization of lower level centers (Level III and Level IV), and no other state designates Level V centers. As a result, there are no data and there is no national experience upon which to base an estimate of need for these centers, which serve primarily as entry points to the system, transferring the majority of patients they evaluate. The utility of such low-level centers is greatest in rural areas where increased system access is critical, and they have little role in the immediate catchment area of a high-level center. Because these centers will transfer the majority of patients, volume performance standards are less applicable and ultimate impact on volume at high-level trauma centers is lower. For these reasons, determination of need should depend less upon population covered per hospital and be more focused on increasing the number of patients that have timely system access.

Level I and Level II Trauma Centers:

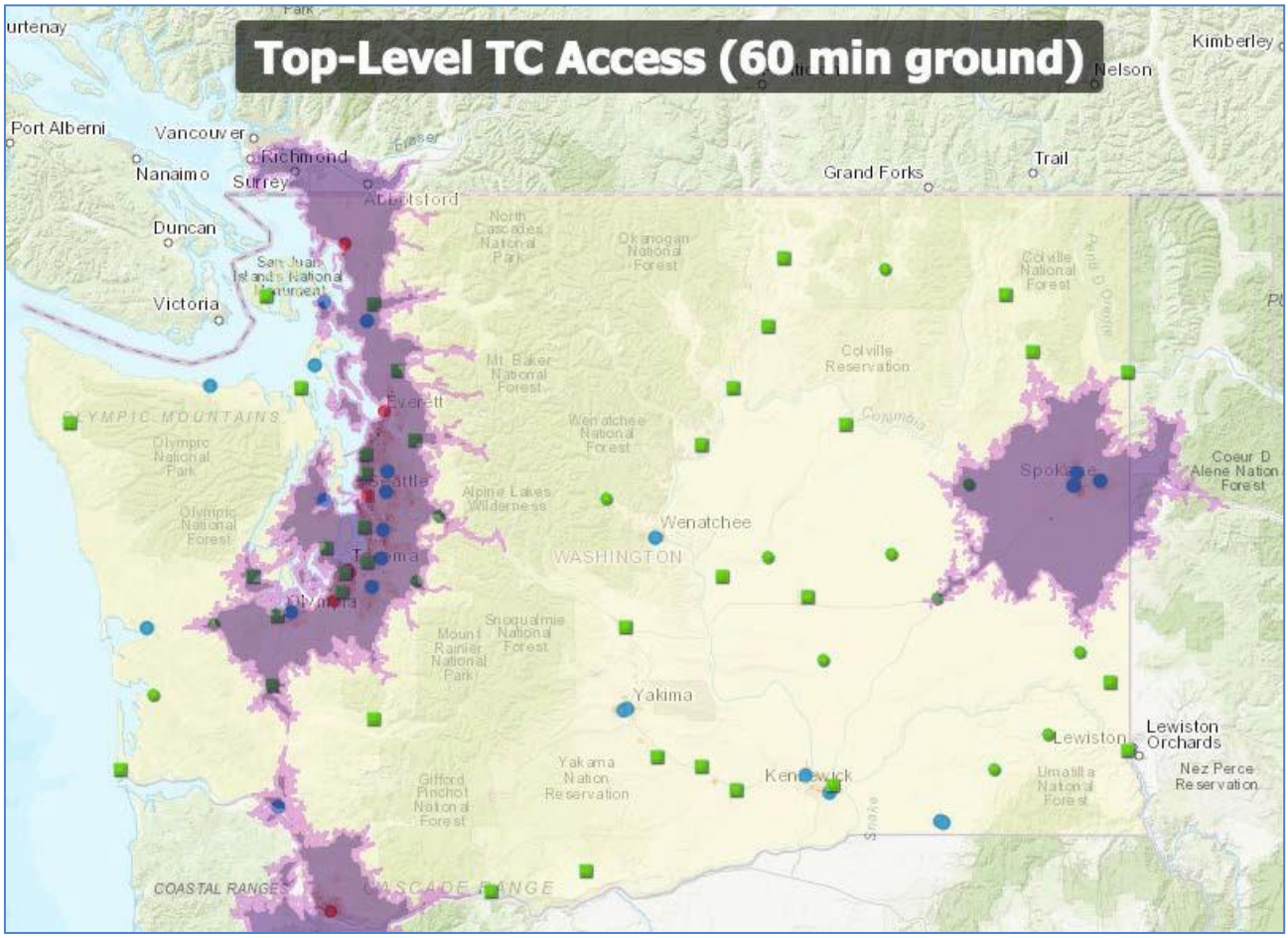

Figure 1: Access to a Level I or Level II trauma center within 60 minutes by ground. Red square = Level I center, Red dot = Level II center, Blue dot = Level III center, Green square = Level IV center, Green dot = Level V center.

All Level Trauma Centers:

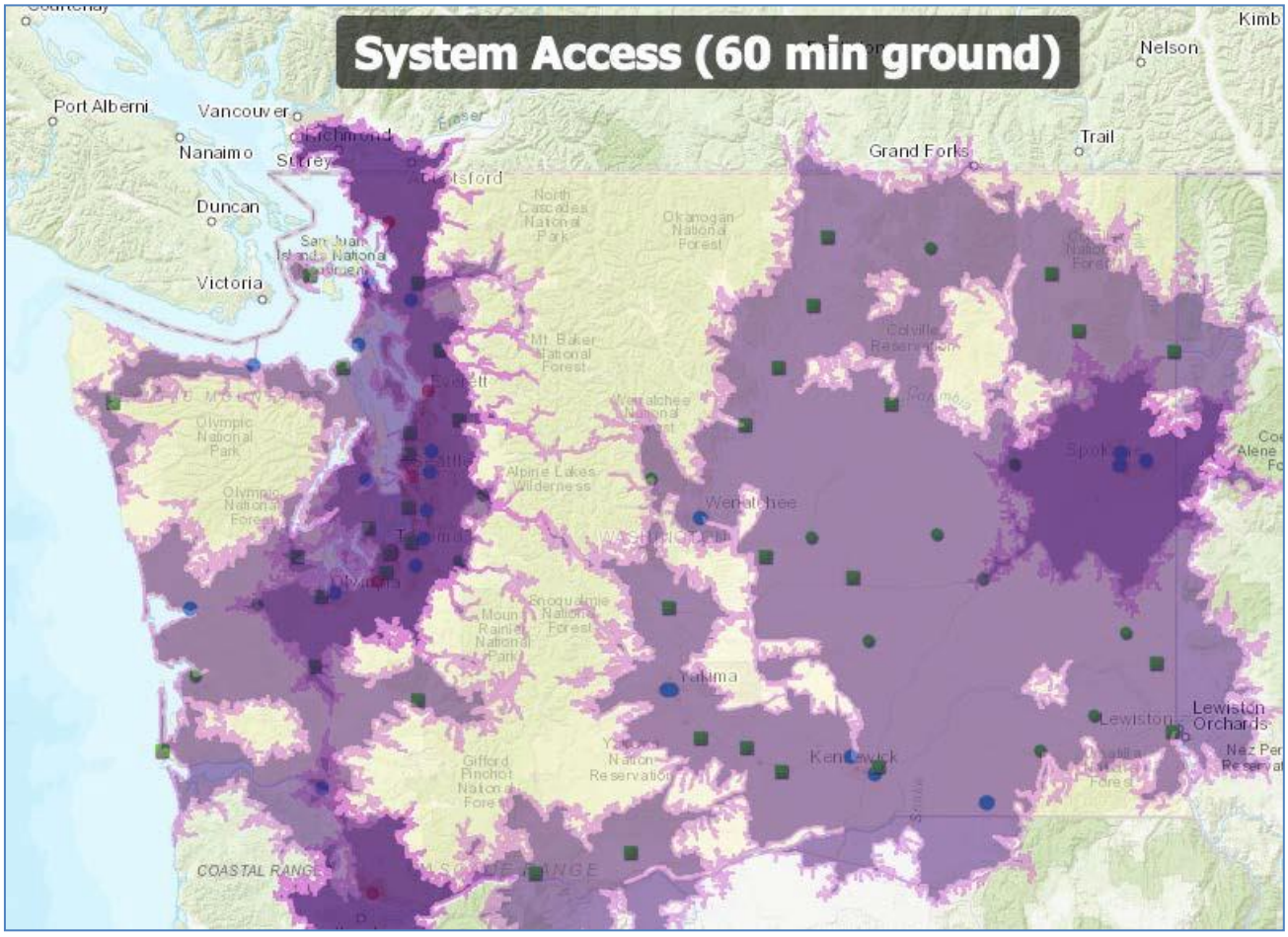

Figure 2: Access to any trauma center within 60 minutes by ground. Red square = Level I center, Red dot = Level II center, Blue dot = Level III center, Green square = Level IV center, Green dot = Level V center.

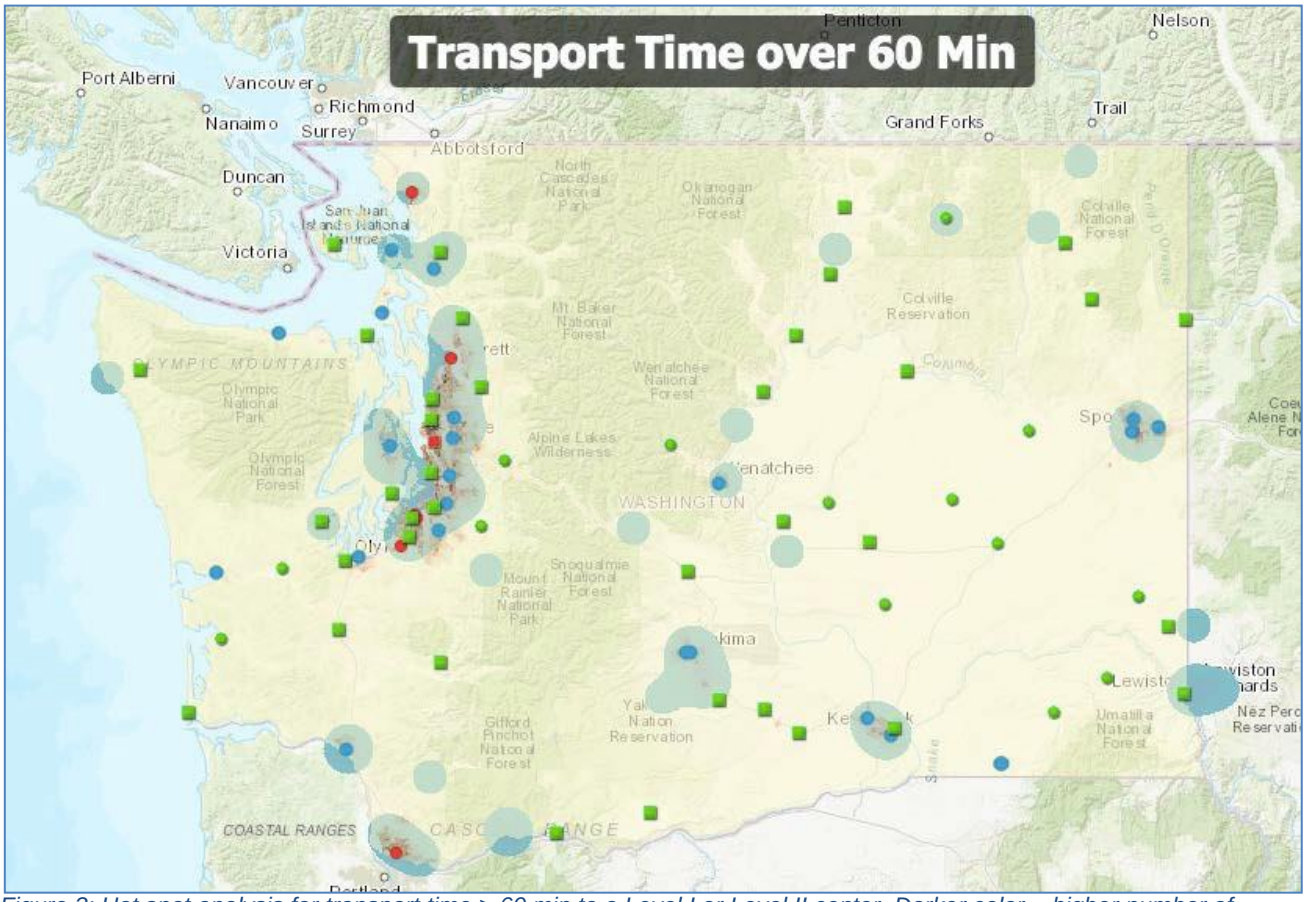

Figure 3: Hot spot analysis for transport time > 60 min to a Level I or Level II center. Darker color = higher number of cases.

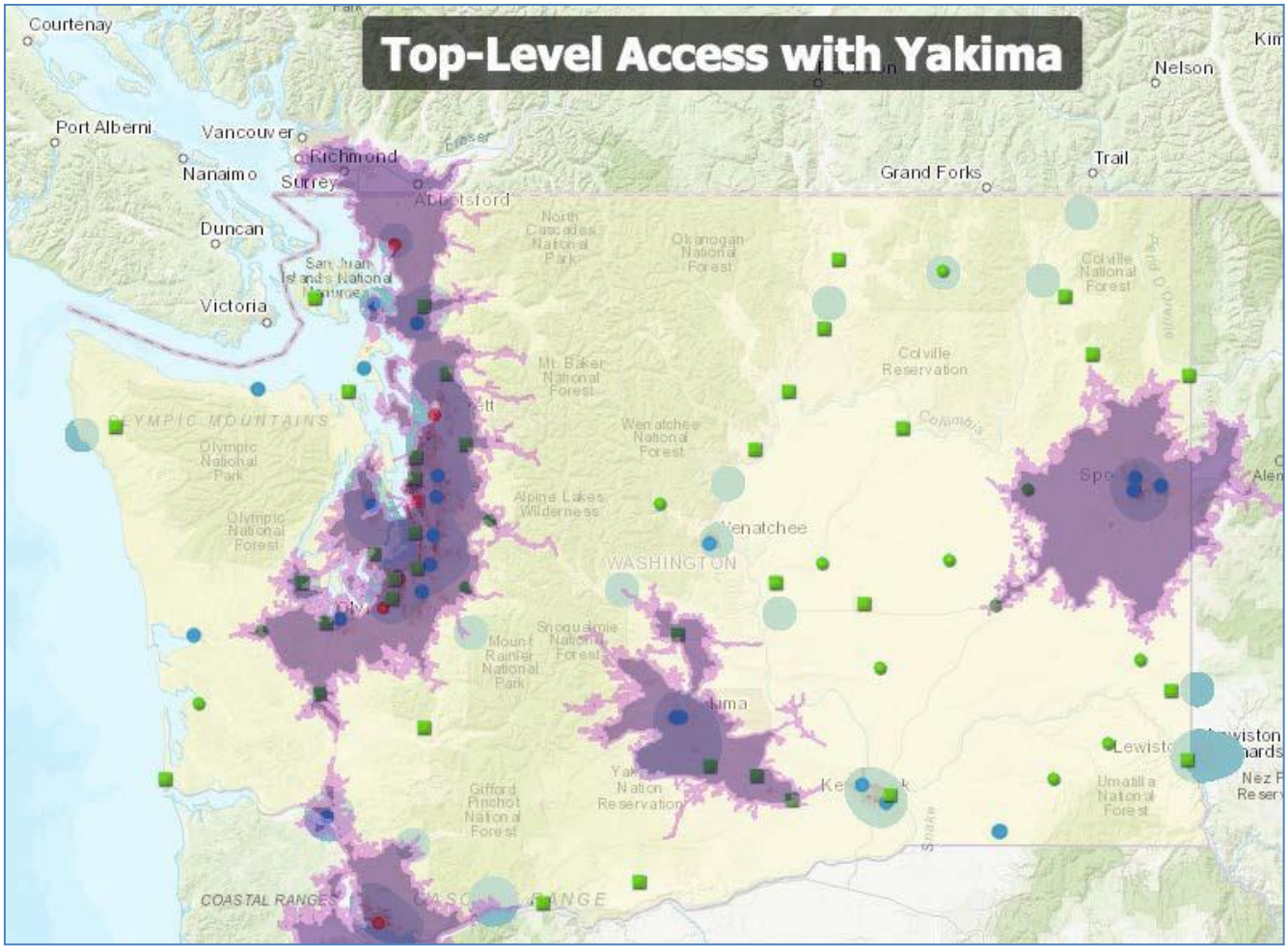

Figure 4: Access to Level I or Level II center with addition of a Level II center in Yakima.

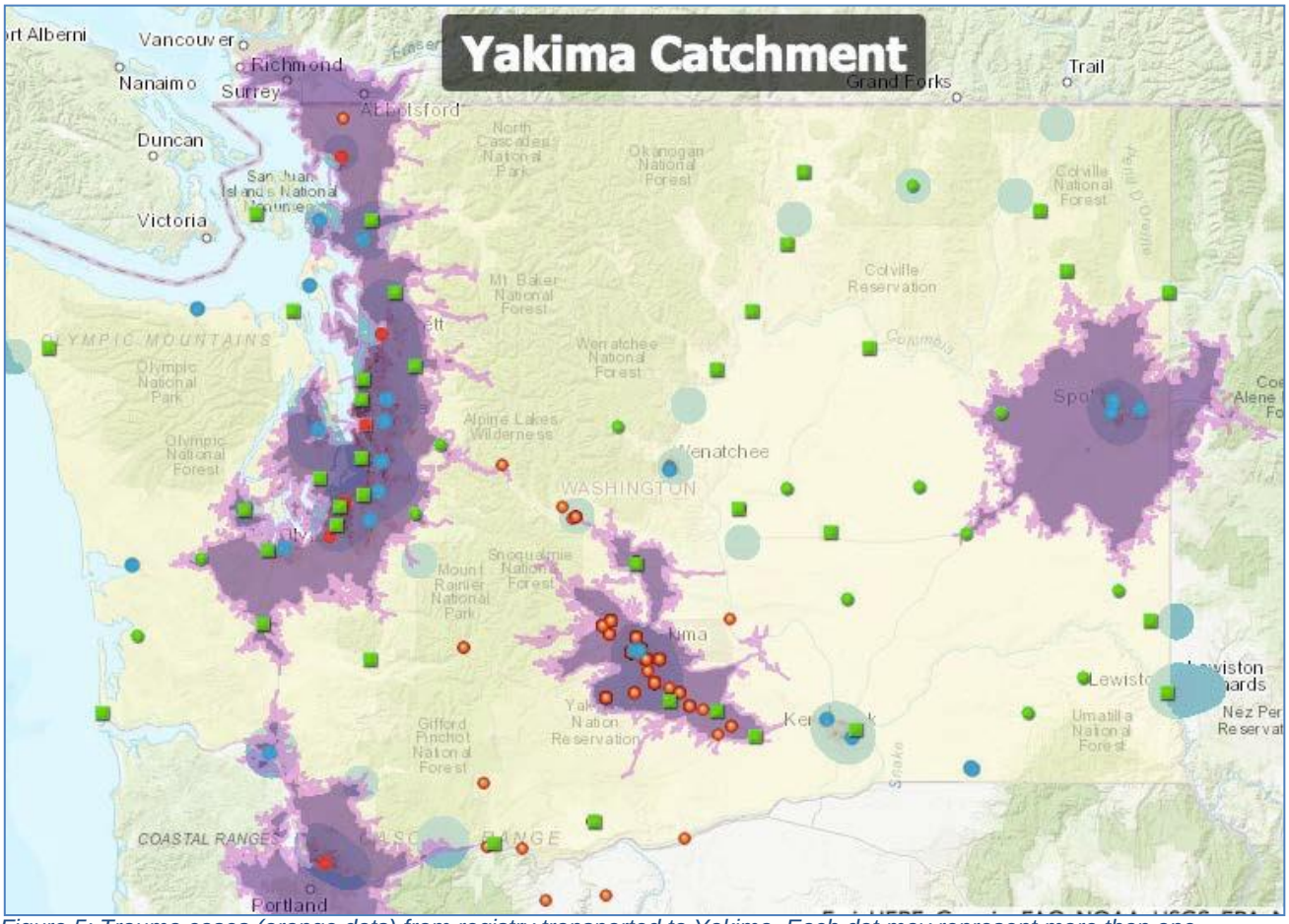

Figure 5: Trauma cases (orange dots) from registry transported to Yakima. Each dot may represent more than one case.

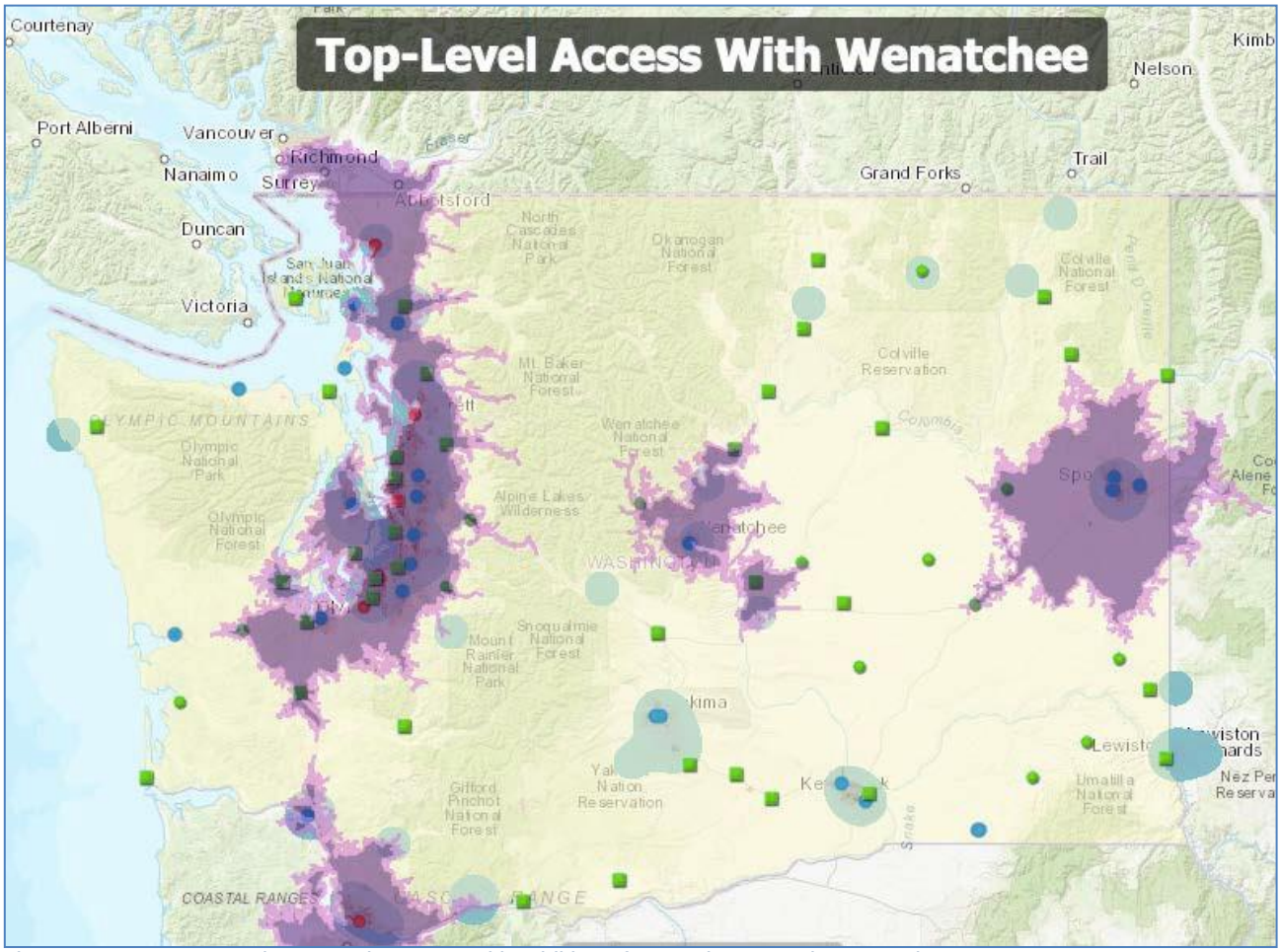

Figure 6: Access to Level I or Level II center with addition of a Level II center in Wenatchee.

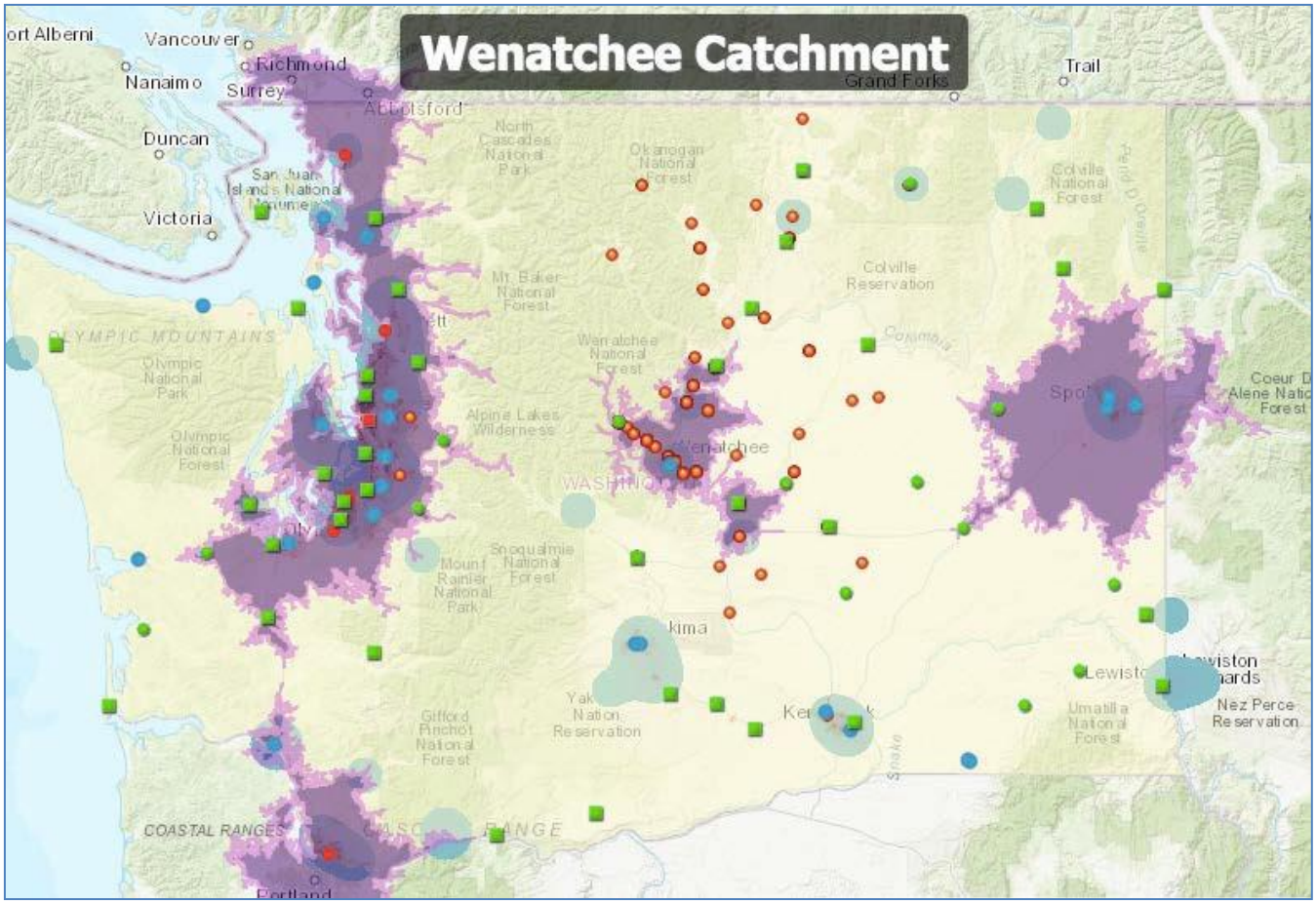

Figure 7: Trauma cases (orange dots).from registry transported to Wenatchee. Each dot may represent more than one case.

Recommendations

- **Establish a clear and transparent process for calculation of minimum/maximum numbers for trauma centers in each region, based on a uniform statewide approach with potential for regional adjustment.**
    - **Potentially utilize a Geographic Information System (GIS) Tool for modeling.**
- **Re-evaluate the purpose and function of the Level I trauma center role, and adjust requirements accordingly.**
- Provide state-level data and analytic support to assist regions with assessment of minimum/ maximum numbers for trauma centers.
- Require all acute care facilities in the state to participate in the system with a minimum set of readiness standards as a condition of licensure.
- Re-evaluate the formula for distribution of trauma center funding to eliminate potential adverse influence on selection of center designation levels.

- Re-evaluate the optimal system balance between centralization of resources and need for regionalized care, resilience, and surge capacity.

System Coordination and Patient Flow

Purpose and Rationale

To achieve the best possible outcomes, the system must be designed so that the right patient is transported to the right facility at the right time. Although on the surface this objective seems relatively straightforward, patients, geography, and transportation systems often conspire to present significant challenges. The most critically injured trauma patient is often easy to identify at the scene by virtue of the presence of coma or hypotension. However, in some circumstances, the patients requiring the resources of a Level I or II center may not be immediately apparent to prehospital providers. Primary or field triage criteria aid providers in identifying which patients have the greatest likelihood of adverse outcomes and might benefit from the resources of a designated trauma center. Even if the need is identified, Regional geography or limited air medical (or land) transport services might not allow for direct transport to an appropriate facility.

Primary triage of a patient from the field to a center capable of providing definitive care is the goal of the trauma system. However, there are circumstances (for example, airway management, rural environments, inclement weather) when triaging a patient to a closer facility for stabilization and transfer is the best option for accessing definitive care. Patients sustaining severe injuries in rural environments might need immediate assessment and stabilization before a long-distance transport to a trauma center. In addition, evaluation of the patient might bring to light severe injuries for which needed care exceeds the resources of the initial receiving facility. Some patients might have specific needs that can be addressed at relatively few centers within a Region (for example, pediatric trauma, burns, severe TBI, SCI, and re-implantation). Finally, temporary resource limitations might necessitate the transfer of patients between acute care facilities.

Secondary triage at the initial receiving facility has several advantages in systems with a large rural or suburban component. The ability to assess patients at non-designated or Level III to V centers provides an opportunity to limit the transfer of only the most severely injured patients to Level I or II facilities, thus preserving a limited resource for patients most in need. It also provides patients with lesser injuries the possibility of being cared for within their community.

The decision to transfer a trauma patient should be based on objective, prospectively agreed-on criteria. Established transfer criteria and transfer agreements will minimize discussions about individual patient transfers, expedite the process, and ensure optimal patient care. Delays in transfer might increase mortality, complications, and length of stay. A system with an excess of transferred patients might tax the resources of the Regional trauma facility. Conversely, inappropriate retention of patients at centers without adequate facilities or expertise might increase the risk of adverse outcomes. Given the importance of timely, appropriate inter-facility transfers, the time to transfer, as well as the rates of primary and secondary over-triage basis, and corrective actions should be instituted when problems are identified. Data derived from tracking and monitoring the timeliness of access to a Level of trauma care commensurate with injury type and severity should be used to help define optimal system configuration.

A central communications center with real-time access to information on system resources greatly facilitates the transfer process. Ideally, this center identifies a receiving facility, facilitates dialogue between the transferring and receiving centers, and coordinates inter-facility transport.

To ensure that the system operates at the greatest efficiency, it is important that patients are repatriated back to community hospitals once the acute phase of trauma care is complete. The process of repatriation opens up the limited resources available to care for severely injured patients. In addition, it provides an opportunity to bring patients back into their local environment where their social network might help reintegrate patients into their community.

Optimal Elements

I. The trauma system is supported by an EMS system that includes communications, medical oversight, prehospital triage, and transportation; the trauma system, EMS system, and public health agency are well integrated. **(B-302)**

- **a.** There are mandatory system-wide prehospital triage criteria to ensure that trauma patients are transported to an appropriate facility based on their injuries. These triage criteria are regularly evaluated and updated to ensure acceptable and system-defined rates of sensitivity and specificity for appropriately identifying a major trauma patient. **(I-302.6)**

- **b.** There is a universal access number for citizens to access the EMS/trauma system, with dispatch of appropriate medical resources. There is a central communications system for the EMS/trauma system to ensure field-to- facility bidirectional communications, inter-facility dialogue, and all-hazards response communications among all system participants. **(I-302.7)**

- **c.** There is a procedure for communications among medical facilities when arranging for inter-facility transfers, including contingencies for radio or telephone system failure. **(I-302.9)**

II. Acute care facilities are integrated into a resource-efficient, inclusive network that meets required standards and that provides optimal care for all injured patients. **(B-303)**

- **a.** When injured patients arrive at a medical facility that cannot provide the appropriate Level of definitive care, there is an organized and regularly monitored system to ensure that the patients are expeditiously transferred to the appropriate system-defined trauma facility. **(I-303.4)**

Current Status

The Washington trauma system was designed to have coordination and patient flow determined by a statewide set of guidelines with regional adjustment. The overall structure of the system is robust, and it generally works well. System stakeholders report good cooperation between hospitals and EMS agencies, and report that patients generally arrive at the appropriate facility in a timely fashion. Some specific patient flow aberrancies, such as double transfers are monitored at the state level.

There are well-established and uniform statewide guidelines for field triage of injured patients that conform to national standards. This tool is applied with minimal modification throughout the

state. There is a similar statewide template to determine destination hospital based on triage level. By its nature, this template requires considerably more specific modification at the regional level, to account for regional trauma center availability, ground EMS transport resources and staffing, air medical coverage, and weather. The infrastructure at the regional level has not proven robust enough to fully customize and monitor use of the destination tool. As a result, complex destination decisions are often at the discretion of the individual transporting unit or the air medical crew, and may follow historical patterns or individual preferences not directly related to patient factors. There are no consistent systems in place to monitor departures from a region's individual guidelines.

There are statewide guidelines governing inter-facility transfers as well. As with field destination guidelines, there is an expectation for regional adjustment, but it appears that most regions lack the infrastructure to maintain and monitor the guidelines. Transfer activity is carefully evaluated at the time of center verification, and departures from expected practice are addressed, but this evaluation only occurs every three years. Monitoring of inter-facility transfers is done on an episodic basis at the state level, seemingly triggered by individual cases.

The distribution of top-level trauma centers at the eastern and western borders of the state creates substantial burden for long-distance transport on agencies in the central portion of the state. There are few statewide resources for long-distance critical care ground transports, and such trips can create a substantial burden for small rural EMS agencies. There is considerable use of air medical resources for these transports, but use of air medical can be seriously hampered by bad weather, leading to at times substantial delays as reported by system stakeholders. There is significant potential benefit in the development of state or regional assets for ground critical care transport, independent of local EMS responding units.

There is a current platform in the state for bed tracking. WaTrac allows central sharing of data on resource utilization and availability. Stakeholders report that this online system to share hospital bed status in a disaster/MCI situation exists, but it is not utilized on a daily basis, especially by the smaller rural hospitals. Given the complexity of destination decisions in some parts of the state, the potential challenges associated with long-distance transport, and the large number of participating centers in the trauma system, there is great potential benefit in a central platform that provides access to resource utilization and availability from any point in the system. This data should include hospital bed and service status, as well as location and status of EMS transportation resources.

Recommendations

- **Provide stronger state-level support for regional operations, especially in the areas of data analysis, capacity assessment, and quality assurance.**

- Strengthen the development and use of decision tools for triage and transport at the regional level, and establish a system to routinely monitor compliance.

- Improve the use of the state-level centralized platform for resource tracking and information sharing within and across regions.

- Consider development of state-level support/coordination for long-distance transfers.

Rehabilitation

Purpose and Rationale

As an integral component of the trauma system, rehabilitation services in acute care and rehabilitation centers provide coordinated care for trauma patients who have sustained severe or catastrophic injuries, resulting in long-standing or permanent impairments. Patients with less severe injuries may also benefit from rehabilitative programs that enhance recovery and speed return to function and productivity. The goal of rehabilitative interventions is to allow the patient to return to the highest Level of function, reducing disability and avoiding handicap whenever possible. The rehabilitation process should begin in the acute care facility as soon as possible, ideally within the first 24 hours. Inpatient and outpatient rehabilitation services should be available. Rehabilitation centers should have CARF (Commission on Accreditation of Rehabilitation Facilities) accreditation for comprehensive inpatient rehabilitation programs, and accreditation of specialty centers (SCI and TBI) should be strongly encouraged.

The trauma system should conduct a rehabilitation needs assessment (including specialized programs in SCI, TBI, and for children) to identify the number of beds needed and available for rehabilitation in the geographic Region. Rehabilitation specialists should be integrated into the multidisciplinary advisory committee to ensure that rehabilitation issues are integrated into the trauma system plan. The trauma system should demonstrate strong linkages and transfer agreements between designated trauma centers and rehabilitation facilities located in its geographic Region (in or out of state). Plans for repatriation of patients, especially when rehabilitation centers across state lines are used, should be part of rehabilitation system planning. Feedback on functional outcomes after rehabilitation should be made available to the trauma centers.

Optimal Elements

I. The lead agency ensures that adequate rehabilitation facilities have been integrated into the trauma system and that these resources are made available to all populations requiring them. **(B-308)**

- **a.** The lead agency has incorporated, within the trauma system plan and the trauma center standards, requirements for rehabilitation services, including inter-facility transfer of trauma patients to rehabilitation centers. **(I-308.1)**

- **b.** Rehabilitation centers and outpatient rehabilitation services provide data on trauma patients to the central trauma system registry that include final disposition, functional outcome, and rehabilitation costs and also participate in performance improvement processes. **(I-308.2)**

II. A resource assessment for the trauma system has been completed and is regularly updated. **(B-103**)

- **a.** The trauma system has completed a comprehensive system status inventory that identifies the availability and distribution of current capabilities and resources. **(I-103.1)**

Current Status

The State of Washington currently has eleven rehabilitation facilities all designated as Level I or II adult or pediatric centers. These are all accredited by the Commission on Accreditation of Rehabilitation Facilities (CARF). These provide 271 total beds available throughout the system with the majority located within urban areas, dispersed throughout different regions with the South Central Region containing the most centers.

There were some differing opinions regarding the average wait for rehabilitation beds by most centers. Upon review of the data from the DOH for years 2013-2017, the average wait was 2.5 days for rehabilitation beds. There is some concern that trauma rehabilitation beds are decreasing while the number of rehabilitation beds for stroke are increasing. The lead agency should monitor this going forward to ensure enough resources are in the system for rehabilitation needs and future sustainment or growth. The sustainability of rehabilitation resources will inherently be derived based upon perceived value to the trauma care system. This assertion underscores the importance of data linkages, particularly those between the acute care facilitation and rehabilitation services. Quality and outcome metrics relative to trauma rehabilitation derived from this data analysis will be vital to support the value proposition for sustained rehabilitation services.

Rehabilitation specialists are currently integrated into trauma system planning via the Rehabilitation Technical Advisory Committee (Rehab TAC). Each rehabilitation facility is represented on the Rehab TAC, regional councils, and the Regional Quality Improvement Committee with the intent to keep the EMS and Trauma Care Steering Committee, as well as region stakeholders informed. However, there is a disconnect of information transfer between the rehabilitation facilities and the trauma centers. This was demonstrated by the lack of knowledge with respect to location and availability of specialized beds, in particular SCI and TBI beds, by trauma center representatives at the stakeholder meetings. Some of the same barriers to access of specialized beds are seen nationwide, including funding, ability to participate for the three-hour requirement, and a twenty-four hour care plan upon discharge. Also revealed in the stakeholder meetings was a lack of knowledge of which facilities possess charity beds and the process to obtain access to these beds for those without funding.

Recommendations

- Develop a methodology for better communication between rehabilitation facilities and trauma facilities with focus on the following:
    - Bed availability
    - Specialized capabilities, specifically SCI and TBI
    - Charity beds and the process of accessing them
- Coordinate in-person visits by trauma centers to rehabilitation facilities to gain better understanding of the rehabilitation capabilities and to strengthen relationships.
- Ensure rural trauma facilities know how to access rehabilitation facilities, which are primarily located in more urban settings.
- Complete the process for linking rehabilitation data with the state trauma registry and disseminate linked data to system stakeholders.

Disaster Preparedness

Purpose and Rationale

As critically important resources for state, Regional, and local responses to MCIs, the trauma system and its trauma centers are central to disaster preparedness. Trauma system leaders need to be actively involved in public health preparedness planning to ensure that trauma system resources are integrated into the state, Regional, and local disaster response plans. Acute care facilities (sometimes including one or more trauma centers) within an affected community are the first line of response to an MCI. However, an MCI may result in more casualties than the local acute care facilities can handle, requiring the activation of a larger emergency response plan with support provided by state and Regional assets.

For this reason, the trauma system and its trauma centers must conduct a resource assessment of its surge capacity to respond to MCIs. The resource assessment should build on and be coupled to a hazard vulnerability analysis. An assessment of the trauma system's response to simulated incident or tabletop drills must be conducted to determine the trauma system's ability to respond to MCIs. Following these assessments, a gap analysis should be conducted to develop statewide MCI response resource standards. This information is essential for the development of an emergency management plan that includes the trauma system.

Planning and integration of the trauma system with plans of related systems (public health, EMS, and emergency management) are important because of the extensive impact disasters have on the trauma system and the value of the trauma system in providing care. Relationships and working cooperation between the trauma system and public health, EMS, and emergency management agencies support the provision of assets that enable a more rapid and organized disaster response when an event occurs. For example, the EMS emergency preparedness plan needs to include the distribution of severely injured patients to trauma centers, when possible, to make optimal use of trauma center resources. This plan could optimize triage through directing less severely injured patients to lower Level trauma centers or non-designated facilities, thus allowing resources in trauma centers to be spared for patients with the most severe injuries. In addition, the trauma system and its trauma centers will be targeted to receive additional resources (personnel, equipment, and supplies) during major MCIs.

Mass casualty events and disasters are chaotic, and only with planning and drills will a more organized response be possible. Simulation or tabletop drills provide an opportunity to test the emergency preparedness response plans for the trauma system and other systems and to train the teams that will respond. Exercises must be jointly conducted with other agencies to ensure that all aspects of the response plan have the trauma system integrated.

Optimal Elements

I. An assessment of the trauma system's emergency preparedness has been completed, including coordination with the public health agency, EMS system, and the emergency management agency. **(B-104)**

- **a.** There is a resource assessment of the trauma system's ability to expand its capacity to respond to MCIs in an all-hazards approach. **(I-104.1)**

b. There has been a consultation by external experts to assist in identifying current status and needs of the trauma system to be able to respond to MCIs. **(I-104.2)**

c. The trauma system has completed a gap analysis based on the resource assessment for trauma emergency preparedness. **(I-104.3)**

II. The lead agency ensures that its trauma system plan is integrated with, and complementary to, the comprehensive mass casualty plan for natural and manmade incidents, including an all-hazards approach to planning and operations. **(B-305)**

a. The EMS, the trauma system, and the all-hazards medical response system have operational trauma and all-hazards response plans and have established an ongoing cooperative working relationship to ensure trauma system readiness for all-hazards events. **(I-305.1)**

b. All-hazards events routinely include situations involving natural (for example, earthquake), unintentional (for example, school bus crash), and intentional (for example, terrorist explosion) trauma-producing events that test the expanded response capabilities and surge capacity of the trauma system. **(I-305-2)**

c. The trauma system, through the lead agency, has access to additional equipment, materials, and personnel for large-scale traumatic events. **(I-305.3)**

Current Status

The State of Washington has several outstanding resources and practices in place to support a robust disaster preparedness plan. Healthcare Coalitions (HCC) to extend the breadth of preparedness resources and response within the state have been coalesced from 9 to 2+ secondary to decreases in federal grant funding previously supported by the Assistant Secretary for Preparedness and Response (ASPR). However, this realignment has largely been viewed as beneficial by trauma system stakeholders. In addition, there seems to be an interactive dialog and a mutual understanding of response responsibilities and capabilities between the trauma system and the preparedness and response systems.

Drills are performed throughout the state on an interval basis to evaluate response and to identify potential opportunities for improvement. After Action Reports (AAR's) are utilized to perform the post-event evaluations. These reports appear well thought out and detail oriented. Similar reports have been utilized following mass casualty incidents (MCI) throughout the state and have proven beneficial in further planning and preparedness. After the recent Amtrak crash event, communication and bed availability tracking were identified as opportunities for improvement in the disaster response system. Despite patient tracking being identified as a weakness after this event and the subsequent decision to purchase a commercial patient tracking system (Statband), this system does not appear to have been consistently utilized during later drills to identify positive and negative aspects of the tool and to develop a plan for improving its usage. This bed availability system (WaTrac) appears to be underutilized but could be instrumental in the daily functional activities of the trauma system to assist with patient flow and bed utilization. Maintaining operational familiarity with this system could prove to be highly beneficial in the event of a real disaster response scenario. The State does not appear to have a functional statewide patient movement plan to transport patients to appropriate level care facilities during disasters.

There is minimal involvement of non-trauma facilities in disaster preparedness at the system level. While it is recognized that many of the facilities throughout the state carry a trauma designation level, there are still several non-designated hospitals. Historically, MCI events across the country highlight that victims will present to any hospital, regardless of their trauma designation status. By ensuring that non-trauma centers are prepared and integrated into the Emergency Preparedness and Response System, patient flow and outcomes may be improved.

The State of Washington has access to military expertise and resources for assistance in disaster preparation. Despite this opportunity, there seems to be a lack of military engagement and involvement in system-wide preparedness response activities.

In addition, there appear to be challenges in operational control and usage of the incident command system, as demonstrated during a recent MCI. Drilling similar scenarios integrating the full centralized incident command process increases familiarization, which may improve response efficiency in the future.

The ACS TSC Review Team identified that the State of Washington has made significant improvement in their disaster planning and management.

Recommendations

- **Develop a regional contingency plan and system redundancy in the event Level I and II centers become incapacitated.**

- Develop enhanced, centralized operational control by better utilization of incident command to coordinate care.

- Improve the integration of the trauma system and Emergency Preparedness and Response Systems.
    - Integrate trauma system and emergency preparedness stakeholders in drills.

- Utilize lessons learned in the After-Action Reports (AAR) from previous mass casualty incidents (MCI) and drills to develop improvements in the disaster plan.

- Increase military involvement in the State's trauma system planning and disaster preparedness efforts.

- Develop a statewide patient movement plan to transport patients to appropriate level care facilities during disasters.

System-wide Evaluation and Quality Assurance

Purpose and Rationale

The trauma lead agency has responsibility for instituting processes to evaluate the performance of all aspects of the trauma system. Key aspects of system-wide effectiveness include the outcomes of population based injury prevention initiatives, access to care, as well as the availability of services, the quality of services provided within the trauma care continuum from prehospital and acute care management phases through rehabilitation and community reintegration, and financial impact or cost. Intrinsic to this function is the delineation of valid, objective metrics for the ongoing quality audit of system performance and patient outcomes based on sound benchmarks and available clinical evidence. Trauma management information systems (MISs) must be available to support data collection and analysis.

The lead agency should establish forums that promote inclusive multidisciplinary and multiagency review of cases, events, concerns, regulatory issues, policies, procedures, and standards that pertain to the trauma system. The evaluation of system effectiveness must take into account the integration of these various components of the trauma care continuum and review how well personnel, agencies, and facilities perform together to achieve the desired goals and objectives. Results of customer satisfaction (patient, provider, and facility) appraisals and data indicative of community and population needs should be considered in strategic planning for system development. System improvements derived through evaluation and quality assurance activities may encompass enhancements in technology, legislative or regulatory infrastructure, clinical care, and critical resource availability.

To promote participation and sustainability, the lead agency should associate accountability for achieving defined goals and trauma system performance indicators with meaningful incentives that will act to cement the support of key constituents in the health care community and general population. For example, the costs and benefits of the trauma system as they relate to reducing mortality or decreasing years of productive life lost may make the value of promoting trauma system development more tangible. A facility that achieves trauma center verification/designation may be rewarded with monetary compensation (for example, ability to bill for trauma activation fees) and the ability to serve as a receiving center for trauma patients. The trauma lead agency should promote ongoing dialog with key stakeholders to ensure that incentives remain aligned with system needs.

Optimal Elements

I. The trauma MIS is used to facilitate ongoing assessment and assurance of system performance and outcomes and provides a basis for continuously improving the trauma system, including a cost-benefit analysis. **(B-301)**

- **a.** The lead trauma authority ensures that each member hospital of the trauma system collects and uses patient data, as well as provider data, to assess system performance and to improve quality of care. Assessment data are routinely submitted to the lead trauma authority. **(I-301.1)**

II. The jurisdictional lead agency, in cooperation with other agencies and organizations, uses analytic tools to monitor the performance of population based prevention and trauma care services. **(B-304)**

III. The financial aspects of the trauma system are integrated into the overall performance improvement system to ensure ongoing fine tuning and cost-effectiveness. **(B-309)**

a. Financial data are combined with other cost, outcome, or surrogate measures, for example, years of potential life lost, quality-adjusted life years, and disability adjusted life years; length of stay; length of intensive care unit stay; number of ventilator days; and others, to estimate and track true system costs and cost- benefits. **(I-309.4)**

Current Status

The statute for peer review protection is broad reaching. However, there is some discrepancy as to what forums are covered under this statute, and perhaps some misinterpretation of the applicability of the statute. The EMS and Trauma Care Steering Committee, through the DOH, should seek legal counsel specific to all system performance improvement (PI) activity.

There are multiple PI requirements for trauma centers. These requirements are verified during the trauma center designation process. There is evidence that the lead agency provides support to the trauma centers to meet these criteria. For example, the state trauma program manager (trauma nurse consultant) provides education on trauma PI to new / incoming TPM's. There are also trauma PI toolkits available including sample trauma center PI master plans.

The PI processes at the state and regional levels vary but are largely incomplete. PI activity does not have supporting documentation to show the complete PI cycle (e.g. issue identification, analysis, recommendations for corrective actions, education and implementation of corrective actions, and evaluation). There is some basic PI being done at the regional and state level. There are regional PI meetings being held with participation from EMS. There are pockets of PI activity that are considered best practices (e.g. radiology misread PI project, providing feedback to transferring hospitals and EMS agencies).

There is evidence that the lead agency is using state trauma registry data to support trauma performance improvement processes. Examples include: transfers to lower level of care, multiple transfers, and delay in transfer for patients with an injury severity score (ISS) > 15. The DOH epidemiologist dedicated to trauma is attending the regional trauma QA meetings and presenting this information. He is ensuring specific case information unique to each region is available to the provider agencies. This allows the individual agencies and trauma centers to complete a detailed case review. However, on the regional and state level, these reports and processes are incomplete from a PI perspective. Missing components are analysis of the data, identification of the issues, corrective actions, implementation of corrective actions, and evaluation of the corrective actions. The lead agency and the regional trauma stakeholders are encouraged to move the trauma PI process to the next level. Additionally, it is recommended that the lead agency implement tracking and reporting of PI activity through meaningful, easily interpreted dashboard reports. The comprehensive trauma performance improvement process is well described in several operational documents developed by the American College of Surgeons Committee on Trauma and the Society of Trauma Nurses.

Trauma center data is being submitted to the state trauma registry. It has been shown to support the PI processes. Other data, however, is missing (e.g. the prehospital provider data).

There are challenges linking PSAP dispatch information and thus PI activities cannot occur as the data is not available.

There is a draft document titled 'Washington State Regional and State Trauma Quality Improvement Filters", dated 2017. The categories of audit filters include EMS, transfers, ED length of stay, full trauma activations, pediatric trauma, outcomes, and rehabilitation. Some items listed are not truly PI filters, rather they are statistical reports. A few of these listed filters have had reports created and presented at the regional meetings. However, there is usually no additional PI activity or loop closure beyond review. The trauma system stakeholders are encouraged to review and update this list of potential PI filters based on data analysis of system needs or potential improvements and stakeholder input; set benchmarks in order to measure and compare progress; review the trauma registry data and provide feedback; prioritize the areas of focus based on data and continue the PI process through to completion (loop closure).

A few regions have drafted a regional PI master plan. For example, the East Region has a draft version (2019 – 2021) of the "Quality Assurance and Improvement Plan for Trauma, Cardiac, and Stroke". This is a comprehensive document that will guide all stakeholders in the region as they mature their PI processes. The plan includes performance measures for trauma, cardiac, stroke, EMS/aeromedical, and rehabilitation. This regional PI plan could be used as a template best practice for other regions that do not have a plan. The lead agency should make available to the regions a clearinghouse for PI toolkits, plans, performance measures, dashboard report samples, and meeting agendas.

There is no dedicated staff at the lead agency to lead system PI activity. It would be beneficial to have 1.0 FTE trauma PI nurse available. This person could lead and support PI activity at the state and regional levels in collaboration with the state and regional TAC's. The lead agency trauma epidemiologist and other trauma staff, in partnership with this new trauma PI trauma nurse would be an asset to moving trauma PI to the next level.

On the regional level, there appears to be intermittent case-based trauma PI activity. In the Central Region, the stakeholders meet three times annually. There is a standard template to submit cases. Reviews include all transfers, PI data from the lead agency presented by the epidemiologist, radiology misreads, and mortality presentations. The East Region meets quarterly and they report there are challenges with attendance and are currently trying various ways to improve participation. Their agenda is usually theme-based and includes case presentations. The North Region holds regular meetings. Although there is no standard agenda, they strive to discuss meaningful issues. The Northwest Region has good participation from the Level III, IV, and V trauma centers. They have linked their meetings with the council meetings to encourage participation.

Recommendations

- **Develop a master plan for system performance improvement on the state and regional levels to implement and complete data-driven performance improvement initiatives.**

- Develop and disseminate contemporary resources, toolkits, and a 'how-to" manual to support state and regional PI activity.

- Seek Department of Health legal review and interpretation of the current peer review protection statute and educate trauma and EMS system stakeholders.

Trauma Management Information Systems

Purpose and Rationale

Hospital-based trauma registries developed from the idea that aggregating data from similar cases may reveal variations in care and ultimately result in a better understanding of the underlying injury and its treatment. Hospital-based registries have proven very effective in improving trauma care within an institution but provide limited information regarding how interactions with other phases of health care influence the outcome of an injured patient. To address this limitation, data from hospital-based registries should be collated into a Regional registry and linked such that data from all phases of care (prehospital, hospital, and rehabilitation) are accessible in 1 data set. When possible, these data should be further linked to law enforcement, crash incident reports, ED records, administrative discharge data, medical examiner records, vital statistics data (death certificates), and financial data. The information system should be designed to provide system-wide data that allow and facilitate evaluation of the structure, process, and outcomes of the entire system; all phases of care; and their interactions. This information should be used to develop, implement, and influence public policy.

The lead agency should maintain oversight of the information system. In doing so, it must define the roles and responsibilities for agencies and institutions regarding data collection and outline processes to evaluate the quality, timeliness, and completeness of data. There must be some means to ensure patient and provider confidentiality is in keeping with federal regulations. The agency must also develop policies and procedures to facilitate and encourage injury surveillance and trauma care research using data derived from the trauma MIS. There are key features of Regional trauma MISs that enhance their usefulness as a means to evaluate the quality of care provided within a system. Patient information collected within the management system must be standardized to ensure that noted variations in care can be characterized in a similar manner across differing geographic Regions, facilities, and EMS agencies. The composition of patients and injuries included in local registries (inclusion criteria) should be consistent across centers, allowing for the evaluation of processes and outcomes among similar patient groups. Many Regions limit their information systems to trauma centers. However, the optimal approach is to collect data from all acute care facilities within the Region. Limiting required data submission to hospitals designated as trauma centers allows one to evaluate systems issues only among patients transported to appropriate facilities. It is also important to have protocols in place to ensure a uniform approach to data abstraction and collection. Research suggests that if the process of case abstraction is not routinely calibrated, practices used by abstractors begin to drift.

Finally, every effort should be made to conform to national standards defining processes for case acquisition, case definition (that is, inclusion criteria), and registry coding conventions. Two such national standards include the National Highway Traffic Safety Administration’s National Emergency Medical Services Information System (NEMSIS), which standardizes EMS data collection, and the American College of Surgeons National Trauma Data Standard (NTDS), which addresses the standardization of hospital registry data collection. Strictly adhering to national standards markedly increases the value of state trauma MISs by providing national benchmarks and allowing for the use of software solutions that link data sets to enable a review of the entire injury and health care event for an injured patient.

To derive value from the tremendous amount of effort that goes into data collection, it is important that a similar focus address the process of data reporting. Dedicated staff and resources should be available to ensure rapid and consistent reporting of information to vested parties with the authority and vision to prevent injuries and improve the care of patients with injuries. An optimal information reporting process will include standardized reporting tools that allow for the assessment of temporal and/or system changes and a dynamic reporting tool, permitting anyone to tailor specific "views" of the information.

Optimal Elements

I. There is an established trauma MIS for ongoing injury surveillance and system performance assessment. **(B-102)**

- **a.** There is an established injury surveillance process that can, in part, be used as an MIS performance measure. **(I-102.1)**
- **b.** Injury surveillance is coordinated with statewide and local community health surveillance. **(I-102.2)**
- **c.** There is a process to evaluate the quality, timeliness, completeness, and confidentiality of data. **(I-102.4)**
- **d.** There is an established method of collecting trauma financial data from all health care facilities and trauma agencies, including patient charges and administrative and system costs. **(I-102.5)**

II. The trauma MIS is used to facilitate ongoing assessment and assurance of system performance and outcomes and provides a basis for continuously improving the trauma system, including a cost-benefit analysis. **(B-301)**

- **a.** The lead trauma authority ensures that each member hospital of the trauma system collects and uses patient data, as well as provider data, to assess system performance and to improve quality of care. Assessment data are routinely submitted to the lead trauma authority. **(I-301.1)**
- **b.** Prehospital care providers collect patient care and administrative data for each episode of care and not only provide these data to the hospital, but also have a mechanism to evaluate the data within their own agency, including monitoring trends and identifying outliers. **(I-301.2)**
- **c.** Trauma registry, ED, prehospital, rehabilitation, and other databases are linked or combined to create a trauma system registry. **(I-301.3)**
- **d.** The lead agency has available for use the latest in computer/technology advances and analytic tools for monitoring injury prevention and control components of the trauma system. There is reporting on the outcome of implemented strategies for injury prevention and control programs within the trauma system. **(I-301.4)**

Current Status

The Washington State Department of Health leads the collection and maintenance of the Washington Trauma Registry. Washington has 122 acute care hospitals, of which 82 are designated trauma centers. All designated centers (Adult Levels I through V and Pediatric Levels I – through III) are required to submit data to the state trauma registry.

Data quality is monitored through regular data logic checks. Reports on errors and data quality issues are sent to the hospitals, and the state has a process to follow up on late and missing data submissions. The state conducts monthly education activities based on needs identified through the data quality process.

The epidemiologist works closely with the registry data and produces statewide and regional reports every other month for the State EMS and Trauma Care Steering committee and TACs. Topics are selected by the TACs.

There is a dedicated lead agency trauma registrar who works in concert with the epidemiologist. She also has convened an ad hoc group of end-users (trauma registrars and trauma program managers), that work on various projects to improve the quality of the trauma registry data. Additionally, she works closely with trauma centers to correct data issues.

It was reported that there have been challenges with the trauma registry technical support and vendor, specifically, an issue with “patches”. The lead agency is encouraged to work to have these issues corrected.

In addition, the registry has linkage potential to several databases, including the Washington Comprehensive Hospital Abstract Reporting System (CHARS), the Washington Trauma Rehabilitation Registry, WEMSIS, and death certificate data from vital statistics. However, the system has not consistently utilized these available linkages to support its needs. Likewise, financial and EMS data have not been fully linked to the trauma registry as EMS is not required to use WEMSIS and many agencies do not.

Recommendations

- **Ensure that trauma registry data are systematically used for trauma system development, evaluation, and performance improvement.**

- Establish a Trauma Registry TAC to provide dedicated leadership for the registry, and to optimize registry management and utilization.

    - Trauma Registry TAC members should include registrars, program managers, and PI coordinators.

- Develop a proactive analytic approach to monitor registry data quality over time, determine root causes, and implement solutions to improve data quality.

- Develop and implement standard operating procedure 1) to ensure that state registry data elements are consistent with the NTDS and 2) to conduct regular review of state registry data elements to ensure relevance and to minimize data collection burden on hospitals.

- Create an internal Department of Health operational manual to detail registry activities and staff responsibilities in order to ensure ongoing functionality through staffing or program transitions.

Research

Purpose and Rationale

Overview of Research Activity

Trauma systems are remarkably diverse. This diversity is simply a reflection of authorities tailoring the system to meet the needs of the Region based on the unique combination of geographic, economic, and population characteristics within their jurisdiction. In addition, trauma systems are not fixed in their organization or operation. The system evolves over years in response to lessons learned, critical review, and changes in population demographics. Given the diversity of organization and the dynamic nature of any particular system, it is valuable when research can be conducted that evaluates the effectiveness of the Regional or statewide system. Research drives the system and will provide the foundation for system development and performance improvement. Research findings provide value in defining best practices and might alter system development. Thus, the system should facilitate and encourage trauma-related research through processes designed to make data available to investigators. Competitive grants or contracts made available through lead authorities or constituencies should provide funds to support research activities. All system components should contribute to the research agenda. The extent to which research activities are required should be clearly outlined in the trauma system plan and/or the criteria for trauma center designation.

The sources of data used for research might be institutional and Regional trauma registries. As an alternative, population-based research might provide a broader view of trauma care within the Region. Primary data collection, although desirable, is expensive but might provide insights into system performance that might not be otherwise available.

Trauma Registry–based Research

Investigators examining trauma systems can use the information recorded in trauma registries to great advantage to determine the prevalence and annual incidence rate of injuries, patterns of care that occur to injured patients in the system's Region, and outcomes for the patients. These data can be compared with standards available from other trauma registries, such as the NTDB. Such comparisons can then enable investigators to determine if care within their Region is within standards and can allow for benchmarking. Initiating and sustaining injury prevention initiatives is a vital goal in mature trauma systems. Investigators can take a leadership role in performing research using trauma registry data that identify emerging threats and instituting public health measures to mitigate the threats. For example, a recent surge in death and disability related to off -road vehicles can be identified and the scope of the problem defined in terms of who, where, and how riders are injured, and then, through presentations and publications, the public can be informed of a new threat.

Trauma system administrators have a responsibility to control investigators' access to the registry. The integrity and reliability of data in a trauma systems registry are essential if accurate research and valid conclusions are to be reached using the data. Trauma system administrators should have a process that screens data entered into the system's composite registry from individual institutions. There should be a mechanism that ensures that the information is stored in a secure manner. Investigators who seek access to the trauma registry must follow a written

policy and procedure that includes approval by an authorized institutional review board. Trauma registry data may include unique identifiers, and system administrators must ensure that patient confidentiality is respected, consistent with state and federal regulations.

Population-based Trauma System Research

A major disadvantage of using only trauma registry data to conduct research that evaluates injured patients in a Region is the bias resulting from missing data on patients not treated at trauma centers. Specifically, most registry data are restricted to information from hospitals that participate in the trauma system. Although ideally all facilities participate in the form of an inclusive system, many systems do not attain this goal. Thus, a population-based data set provides investigators with the full spectrum of patients, irrespective of whether they have been treated in trauma centers or non-designated centers or were never admitted to the hospital owing to death at the scene of incident or because their injuries were insufficiently severe to require admission. The state and national hospital discharge databases are examples of population-based data. These discharge databases contain information that was abstracted from medical records for billing purposes by hospital employees who enter these data into an electronic database. For investigators seeking a wider perspective on the care of injured patients in their Region, these more inclusive data sets, compared with registries, are essential tools. Other population-based data that may be of help include mortality vital statistics data recorded in death certificates. Selected Regions might have outpatient data to capture patients who are assessed in the ED and then released.

Investigators can use these population-based data to study the influence of a Regional trauma system on the entire spectrum of patients within its catchment area.

Participation in Research Projects and Primary Data Collection

Multi-institutional research projects are important mechanisms for learning new knowledge that can guide the care of injured patients. Investigators within trauma systems can participate as coinvestigators in these projects. Investigators can participate by recruiting patients into prospective studies, being leaders in the design and administration of grants, and preparing manuscripts and reports. Evidence of this collaboration is that investigators within a trauma system are recognized in announcements of grants or awards. Lead agency personnel should identify and reach out to resources within the system with research expertise. These include academic centers and public health agencies.

Measures of Research Activity

Research can be broadly defined as hypothesis-driven data analysis. This analysis leads the investigators to a conclusion, which might become a recommendation for system change. Full manuscripts published in peer reviewed research journals are an exemplary form of research activity. Research reported in annual reviews or in public information formats intended to inform the trauma system’s constituency can also be considered legitimate research activity.

Optimal Elements

I. The trauma MIS is used to facilitate ongoing assessment and assurance of system performance and outcomes and provides a basis for continuously improving the trauma system, including a cost-benefit analysis. **(B-301)**

a. The lead agency has available for use the latest in computer/technology advances and analytic tools for monitoring injury prevention and control components of the trauma system. There is reporting on the outcome of implemented strategies for injury prevention and control programs within the trauma system. **(I-301.4)**

II. The lead agency ensures that the trauma system demonstrates prevention and medical outreach activities within its defined service area. **(B-306)**

a. The trauma system has developed mechanisms to engage the general medical community and other system participants in their research findings and performance improvement efforts. **(I-306.1)**

b. The effect or impact of outreach programs (medical community training/support and prevention activities) is evaluated as part of a system performance improvement process. **(I-306.3)**

III. To maintain its state, Regional, or local designation, each hospital will continually work to improve the trauma care as measured by patient outcomes. **(B-307)**

a. The trauma system implements and regularly reviews a standardized report on patient care outcomes as measured against national norms. **(I-307.2)**

Current Status

There is a clear process for obtaining data from the state via the lead agency. Once a request is submitted, it is screened to ensure the request can be fulfilled and is appropriate. The request is then passed on to the Washington State Institutional Review Board (IRB) for final approval. There are state laws in place for protection of patient confidentiality. External sharing of de-identified data is permissible after DOH and IRB approval.

The ACS TSC Review Team noted that the state epidemiologist is a great asset. His knowledge and involvement seem to be a benefit to all regions of the state. It appears that there is a great deal of both regional and state trauma research performed based on data obtained by the state. There is a high level of research expertise within Washington, particularly in the Central Region, as one would expect with the large academic presence. However, the expertise and resources for research are somewhat centralized. There are opportunities to increase research opportunities outside the Central Region.

It would appear that the research performed on state obtained data does drive changes in the processes of care including: modifications to response times, trauma team activations, use of intubation instruments, medications utilized, and the development of guidelines utilized at all levels of the trauma continuum throughout the regions and the state. Most recently, an evaluation of splenic trauma in the pediatric patient was performed.

There is a lack of understanding of the existing data usage agreements, which may limit the research being done on state obtained data. Better understanding would help facilitate the sharing of state data with interested parties who are seeking to enhance trauma care throughout the state by performing studies on state obtained data. This would specifically enhance regional gap evaluations and PI at all levels.

Recommendations

- Utilize data usage agreements (DUAs) to enhance the availability of Department of Health data.

- Encourage data use to perform studies aimed at enhancing the safety of the citizens of Washington State.

- Develop a method to encourage Level II-V trauma centers to be more involved in research.

APPENDIX A: Acronyms

AAR – After Action Report
AARP – American Association of Retired Persons
ACEP – American College of Emergency Physicians
ACS – American College of Surgeons
ALS – Advanced Life Support
ASPR – Assistant Secretary for Preparedness and Response

BIS – Benchmarks, Indicators and Scoring
BLS – Basic Life Support
BRFSS – Behavioral Risk Factor Surveillance System

CARF – Commission on Accreditation of Rehabilitation Facilities
CHARS – Comprehensive Hospital Abstract Reporting System
COT – Committee on Trauma

DOH – Department of Health
DUA – Data Usage Agreement

E-911 – Enhanced 911
EMS – Emergency Medical Services
EMST – EMS and Trauma Care Council

FACEP – Fellow of the American College of Emergency Physicians
FACS – Fellow of the American College of Surgeons
FAEMS – Fellow of the Academy of Emergency Medical Services
FTE – Full-time Equivalent

GIS – Geographic Information Systems

HCC – Healthcare Coalitions
HIPRC – Harborview Injury Prevention and Research Center
HRSA – Health Resources and Services Administration

IRB – Institutional Review Board
ISS – Injury Severity Score
IVP – Injury and Violence Prevention

MADD – Mothers Against Drunk Driving
MCI – Mass Casualty Incident
MIS – Management Information Systems
MPD – Medical Program Director

NASEMSO – National Association of State EMS Officials
NBATS – Needs Based Assessment of Trauma Systems
NEMSIS – National Emergency Medical Services Information System
NTDB – National Trauma Data Bank
NTDS – National Trauma Data Standards

PI – Performance Improvement
PRQ – Pre-Review Questionnaire
PSAP – Public Safety Answering Points

QA – Quality Assurance
QI – Quality Improvement

RCW – Revised Code of Washington
RHINO – Rapid Health Information System

SCI – Spinal Cord Injury
Statband – Patient tracking system
STSAC – State Trauma System Advisory Committee

TAC – Technical Advisory Committee
TBI – Traumatic Brain Injury
TPM – Trauma Program Manager
TQIP – Trauma Quality Improvement Program
TSC – Trauma System Consultation

WAC – Washington Administrative Code
WaTrac – Washington bed tracking platform
WEMSIS – Washington State Emergency Medical Information System

ZIP – USPS Zone Improvement Plan

APPENDIX B: Methodology

The State of Washington Department of Health (DOH) requested this consultative review of the Washington Trauma System, which was conducted under the auspices of the Trauma Systems Consultation (TSC) Program of the American College of Surgeons (ACS) Committee on Trauma (COT). The multidisciplinary TSC Review Team consisted of 2 ACS staff and 7 nationally recognized trauma experts, including: three trauma surgeons, an emergency medicine physician, a state emergency medical services director, a trauma program manager, and one trauma systems specialty reviewer. Biographical information about the 9 ACS TSC Review Team Members is provided in Appendix C.

The primary objective of the ACS TSC for the State of Washington was to guide and promote a sustainable effort in the graduated development of an inclusive and integrated system of care within the state. The format of this TSC Report correlates with the public health framework of assessment, policy development, and assurance outlined in the ACS *Regional Trauma Systems Optimal Elements, Integration, and Assessment: System Consultation Guide*. Prior to the visit, the TSC Review Team studied the ACS Pre-Review Questionnaire (PRQ) and additional supporting documents, submitted by the State of Washington DOH. Other information publicly available on government and official websites was also assessed.

The ACS TSC Review Team convened a Site Visit from April 22nd to April 26th, 2019 in Tumwater, WA. The five-day visit consisted of several plenary sessions during which the ACS TSC Review Team engaged with a broad range of representatives from the State Trauma System, with the opportunity for more informal discussions to take place in between. The ACS TSC Review Team also sequestered in private Team meetings for more detailed reviews of the State of Washington data, to establish consensus on essential elements regarding the Trauma System, develop recommendations for system improvement, and to prepare the TSC Report.

The conceptual framework of the ACS *Regional Trauma Systems Optimal Elements, Integration, and Assessment: System Consultation Guide* was based on the Health Resources and Services Administration (HRSA) *Model Trauma System Planning and Evaluation (MTSPE)* document, released in 2006. The public health approach to trauma systems described within the HRSA MTSPE document informed the Purpose and Rationale for each of the 18 trauma system components, or sections, within the *System Consultation Guide*. The Benchmarks from the HRSA *MTSPE* were adapted directly into the *System Consultation Guide*, but categorized under the appropriate and relevant trauma system components, under the Optimal Elements heading. For reference, each Benchmark under the Optimal Elements includes its numerical designation from the HRSA *MTSPE* document. According to the HRSA *MTSPE* document's description, "Benchmarks are global overarching goals, expectations, or outcomes. In the context of the trauma system, a benchmark identifies a broad system attribute."

The Trauma System Consultation (TSC) Report presents the same Purpose and Rationale and Optimal Elements, as those within the *System Consultation Guide* for each of the 18 trauma system components.

References:

American College of Surgeons Committee on Trauma. *Regional Trauma Systems Optimal Elements, Integration, and Assessment: System Consultation Guide.* Chicago, IL: American College of Surgeons: 2008.

Health Resources and Services Administration. *Model Trauma System Planning and Evaluation*. Rockville, MD: Health Resources and Services Administration; 2006.

APPENDIX C: ACS TSC Review Team Biographies

COL. BRIAN J. EASTRIDGE, MD FACS
Role: Trauma Surgeon, Team Lead

Dr. Brian Eastridge received his BS in biochemistry from Virginia Tech in 1985 and his MD from the University of Maryland School of Medicine in 1989. He entered the US Army Reserve as a second lieutenant Medical Service Corps officer in 1988. Dr. Eastridge did his residency in general surgery at the University of Maryland Medical System and then pursued fellowship training in surgical critical care at the University of Texas Southwestern Medical Center in Dallas, TX. During his tenure on the academic faculty at UTSW, Dr. Eastridge was deployed three times in support of combat operations Operation Enduring Freedom and Operation Iraqi Freedom as a U.S Army Reserve surgeon in 2002, 2003, and 2004. During his deployment in 2004, he was appointed as the first Joint Theater Trauma System Director.

Dr. Eastridge matriculated to active duty U.S Army in 2005 and served as Trauma Medical Director for the Brooke Army Medical Center, Surgical Critical Care Program Director for SAUSHEC, Director of the Joint Trauma System (U.S. Army Institute of Surgical Research of the U.S. Army's Medical Research and Material Command (MRMC), and Trauma Consultant to the US Army Surgeon General. During his active duty service, he was deployed two more times to combat in Southwest Asia during which time he lead the development and implementation of the military trauma system.

During his career, Dr. Eastridge has published extensively in the peer reviewed literature and edited three books focused upon improving the military trauma system and improving combat casualty care outcomes for our Wounded Warriors. Dr. Eastridge left active service and returned to the active US Army Reserves in late 2012 and is currently the DCCS of the 228th Combat Support Hospital. His military awards and decorations include the Combat Medical Badge, Combat Action Badge, Legion of Merit, Bronze Star Medal, Defense Meritorious Service Medal, and the Joint Service Commendation Medal. He is a member of Order of Military Medical Merit. For his military service, he has been awarded the American Association for the Surgery of Trauma Honorary Medal for Combat Surgical Care in 2004 and the US Army Medical Research and Materiel Command Combat Casualty Care Program Award for Excellence in 2011.

Currently, he is Professor of Surgery at the University of Texas Health Science Center and was appointed as the Trauma Medical Director of the University Health System in San Antonio, TX. He holds the Jocelyn and Joe Straus Endowed Chair in Trauma Research. His current research interests are focused on trauma system development, including development of the regional trauma system performance improvement initiatives, predictive modeling of injury outcomes, and improved pre-hospital resuscitation strategies for casualties. Dr. Eastridge also serves as an active member on the American College of Surgeons Committee on Trauma, and is the current Chair of the Trauma Systems Evaluation and Planning Committee, and the Trauma Systems Pillar.

JOSEPH IBRAHIM, MD FACS
Role: Trauma Surgeon (Disaster/ MCI Management Reviewer)

Dr. Joseph Ibrahim is board certified in both General Surgery and Surgical Critical Care. Dr. Ibrahim received his medical degree from the James H. Quillen College of Medicine of East Tennessee State University in 2003. He was Vice President of his class and was awarded the Arnold P. Gold Humanism in Medicine Award. Dr. Ibrahim completed post-graduate residency training in general surgery at East Tennessee State University and was recognized with the Outstanding Surgical Resident Award.

Dr. Ibrahim honed his skills at caring for the most critically ill patients during his Surgical Critical Care Fellowship at Orlando Health. With his residency and fellowship concluded, Dr. Ibrahim stayed at East Tennessee University as Assistant Professor with the Division of Trauma/Critical Care/Acute Care Surgery. He found success in working with surgical residents first as Assistant Professor, then as Interim Vice Chair of the Surgery Department. He also worked as a general surgeon in a private practice, and

though his experiences seasoned him as a surgeon, he was glad for the opportunity to be part of graduate medical education again. He joined Orlando Health's Department of Surgical Education in January 2012 as Associate Program Director of the General Surgery Residency. His passion for laudable patient care was recognized in 2013 with the Orlando Regional Medical Center Physician Exemplar Award. In August 2015, Dr. Ibrahim was appointed as the Medical Director of Trauma at Orlando Health's Level I Trauma Center in Orlando, Florida.

Dr. Ibrahim is interested in many areas of general and trauma surgery including REBOA, endoscopy, hernias, abdominal wall reconstruction, laparoscopy, gallbladder, thyroid, and bowel surgery.

ROBERT J. WINCHELL, MD FACS
Role: Trauma Surgeon (Focused Analysis Specialty Reviewer)

Dr. Robert Winchell received his undergraduate degree from the California Institute of Technology, his M.D. from Yale University, and did his internship, General Surgery residency, and Trauma and Critical Care Fellowship at the University of California, San Diego, where he remained on the faculty as Associate Professor of Clinical Surgery in the Division of Trauma through 1999. After leaving the University of California, Dr. Winchell established and subsequently directed the Tacoma Trauma Center in Tacoma, Washington, which continues to operate successfully as a joint venture between two previously competing hospitals. In 2001, Dr. Winchell moved to the Maine Medical Center and assumed the role of Head of the Division of Trauma and Burn Surgery in 2004. He remained in that position for 10 years, also serving as an Associate Professor of Surgery at the Tufts University School of Medicine. Under his direction, Maine Medical Center became a verified Level I trauma center for the first time in 2007. After leaving Maine, Dr. Winchell served as Chief of Trauma and Visiting Professor of Surgery at the University of Texas Health Science Center at Houston and Chief of Trauma at Memorial Hermann -Texas Medical Center until assuming his current post. In July 2015, Dr. Winchell joined the faculty in the Department of Surgery at Weill Cornell Medical College as Chief of the Division of Trauma, Burns, Acute and Critical Care and Director of the Trauma Center at New York-Presbyterian Weill Cornell Medical Center.

Dr. Winchell has been deeply interested and involved in the development and evolution of trauma systems for his entire career. He has been involved in trauma center and trauma systems design and operation in a wide variety of settings covering the spectrum of system development. He was instrumentally involved in leadership roles with both the day-to-day operations and ongoing development of the San Diego County trauma system for over ten years and served as chair of the San Diego and Imperial County Committee on Trauma. He participated in the leadership, operation and ongoing development of the Washington state trauma system, serving on the state advisory board, and as chair of the Southwest EMS region. During Dr. Winchell's tenure in Maine, he helped to develop the Maine state system, serving as a member of the state advisory board and as a chairman of the Maine State Committee on Trauma. In Texas, he served on the Trauma Systems subcommittee of the Governor's EMS and Trauma Advisory Council. Dr. Winchell is a leader in international trauma systems development, and the founding representative from the American College of Surgeons to the World Health Organization's Global Alliance for the Care of the Injured.

In parallel to his clinical and research work, Dr. Winchell has had the honor to serve the American College of Surgeons Committee on Trauma for almost 20 years, first as a State Chair for San Diego County and for Maine, and currently as a member and part of the Executive Committee. His leadership and forethought have been instrumental to the Trauma Systems Consultation Program of the COT since 2006, and he currently serves as Chair of the Trauma Systems Evaluation and Planning Committee. In that role, he has conducted expert consultation in 18 states and regions, serving as team leader for 14 of these, and has also participated in trauma systems work internationally. Dr. Winchell is also a senior reviewer for the Trauma Center Verification Program of the College.

Dr. Winchell has dedicated almost two decades to the advancement care of the injured as a part of national public health policy, and the implementation of state and regional trauma systems based upon and supported by that policy.

Dr. Winchell is Board certified in General Surgery, with added qualifications in Surgical Critical Care. He is a Fellow of the American College of Surgeons as well as a member of the American Association for the Surgery of Trauma, the Association for Academic Surgery, the Southwest Surgical Congress, the Society of Critical Care Medicine and the New England Surgical Society. Dr. Winchell is author of more than 50 scientific papers and book chapters, and has given over 100 regional, national and international presentations. He is an ad hoc reviewer for the Journal of Trauma and Acute Care Surgery, the Archives of Surgery and the World Journal of Surgery.

DEBRA G. PERINA, MD FACEP FAEMS
Role: Emergency Medicine Physician

As a tenured Professor of Emergency Medicine at the University of Virginia, Dr. Perina has built a national reputation for leadership, mentoring and training in Emergency Medicine and EMS systems. Dr. Perina completed her medical training at the West Virginia University School of Medicine in 1983 and her residency in Emergency Medicine in 1987 at the Richland Memorial Hospital/USC SOM. She remained as faculty, then residency Program Director, prior to moving to Virginia, where she is Director if the Prehospital care Division and EMs Fellowship Director. Dr. Perina is the former EMS Medical Director for South Carolina, where she led the building of the state's trauma system.

Dr. Perina is the recipient of numerous awards including the South Carolina Medical Control Physician of the Year award (1989), Outstanding EMS Physician regional award in Virginia (2010 and 2016), The Ronald D Stewart lifetime achievement award from the National Association of EMS Physicians and the Outstanding Contributions in EMS national award from the American College of Emergency Physicians.

Dr. Perina has furthered the goals education in EM and EMS leading the efforts to revise the Model of the Clinical Practice of Emergency Medicine, and the creation of the EMS Medicine Core Content. She also created the successful application for subspecialty recognition of EMS by the American Board of Medical Specialties in 2010 and spearheaded the creation of the first EMS Medicine certification examination. She is immediate Past- Chair of the EMS examination task force for the American Board of Emergency Medicine.
Dr. Perina continues to serve her community as a volunteer Medical Examiner and is Medical Director for several local EMS services, Fire Departments and Rescue Squads.

DREXDAL PRATT
Role: State Emergency Medical Services Director

Mr. Pratt retired as Director of the Division of Health Service Regulation (DHSR) in the North Carolina Department of Health and Human Services (DHHS) in January 2016. His division managed the all healthcare facility regulatory activities within the DHHS and included the Office of Emergency Medical Services and Trauma and the Assistant Secretary for Preparedness and Response (ASPR) Hospital Preparedness Cooperative Agreement.

Mr. Pratt is a graduate of the Institute of Government at the University of North Carolina at Chapel Hill, the EMS Management Institute at the University of North Carolina at Charlotte, and Forsyth Technical Community College. He is also a Certified Emergency Manager (CEM) and a Certified Public Manager (CPM).

Mr. Pratt joined the North Carolina Office of Emergency Medical Services in 1987 as a Regional Coordinator. He was promoted through the ranks, first to Regional Supervisor, and then to Chief of the agency in 1999. In August 2010 Mr. Pratt was promoted to the Director position of DHSR. Mr. Pratt served two terms as Chair of the Region I EMS Advisory Council. He received the National Association of County Commissioner’s Achievement Award for coordinating the development of the Stokes County NC computer-aided dispatch program.

He has served as a Commissioner on the Governor’s State Emergency Response Commission and served as Chairman of the Commission’s Homeland Security Medical Committee. In addition, Mr. Pratt

served as Secretary of the North Carolina Medical Care Commission, and Commissioner on the North Carolina Radiation Protection Commission.

In October 2009 Mr. Pratt received the North Carolina Medical Society's John Huske Anderson Award. This award recognizes individuals for whose contributions have made a positive impact on the medical profession and the public health. In addition, Mr. Pratt was presented the Order of the Long Leaf Pine in October 2010 from Governor Beverly Perdue. This is the highest civilian honor presented by the Governor and is presented to individuals who have a proven record of extraordinary service to the state.

HEIDI A. HOTZ, RN
Role: State Trauma Program Manager

Ms. Heidi Hotz is the Trauma Program Manager at Cedars-Sinai Medical Center, a Department of Health designated and ACS verified Level I Trauma Center. She is also the President of the Los Angeles Association of Trauma Program Managers as well as the Immediate Past President of the American Trauma Society (ATS), Past President of the Society of Trauma Nurses (STN), and Past President of the Trauma Managers Association of California (TMAC).

Ms. Hotz has extensive experience in all aspects of trauma including clinical care, program management, trauma data, trauma performance improvement and patient safety, trauma systems, injury prevention, consultation for trauma centers and systems, educational curriculum development, conference and event planning and all trauma related issues across the continuum of care.

Additionally, Ms. Hotz is the recipient of the STN's Trauma Leadership Award. She has been a survey team member for the ACS Trauma Systems and Evaluation Program. She has been an invited expert panel member for many national trauma initiatives and projects such as the ATS Leadership Forums, the screening & brief intervention for alcohol in trauma initiatives, the Model Trauma System Plan work group, to name a few. She has lectured on a wide variety of trauma related topics throughout the United States and internationally. She has extensive participation at the member and Chair levels for local, regional, state and national committees. She was the Chair of the Advanced Trauma Care for Nurses® (ATCN) Committee in Arizona for 6 years. She was then appointed the first Chair of the STN's ATCN National-International Committee and spearheaded the special projects team to attain the ACS COT approval of the program as a collaborative effort with the ATLS Subcommittee. She was a member of the STN Board of Directors for over 8 years in the positions of Director at Large, Treasurer, President Elect and President. She is an author and Faculty Member for the STN's Trauma Outcomes Performance Improvement Course (TOPIC).

MELANIE NEAL, MS
Role: Trauma Specialty Reviewer (Trauma Management Information Systems Reviewer)

Ms. Neal has been with the American College of Surgeons for fourteen years, and is the Senior Manager of Trauma Quality Programs, as well as the Manager of the National Trauma Data Bank (NTDB) and the Trauma Quality Improvement Program (TQIP). In this position, she provides strategic direction and high Level management for scientific, business, and product operations areas.

In addition, Ms. Neal works with a variety of data and quality initiatives of the Committee on Trauma, that support the mission of the COT to improve care for the injured patient. She represents the COT programs of the ACS on this consultation.

Ms. Neal has a Master's degree in Social Science Research Methods.

HOLLY MICHAELS, MPH
Role: ACS Trauma Program Staff (TSC Review Team Discussion Facilitator and TSC Report Editor)

Ms. Holly Michaels joined the American College of Surgeons (ACS) in January 2007, and has served in several key areas of the Trauma Quality Programs during her tenure at the ACS. As the Program

Administrator for the Trauma Systems Consultation Program, Ms. Michaels managed over 30 state and Regional system reviews, bringing together multidisciplinary teams of industry experts to assess, evaluate, and recommend strategic improvements for state and Regional trauma systems. Following several years facilitating the growth and development of this program, she transitioned into a Program Manager role, leading the development of new programs including piloting the Level III Trauma Quality Improvement Program (TQIP) and expanding the TQIP Collaborative Program. In her role as Program Manager, her responsibilities continue to evolve to match the growth of programs and needs of stakeholders.

Having received her Bachelor of Arts in English from the University of South Florida in 2001, Ms. Michaels began her career in public health at the non-profit organization, 2-1-1 Tampa Bay Cares, providing the Clearwater, FL community with access to critical resources, such as health and social services. In August 2014, Ms. Michaels earned a Master of Public Health from the University of Illinois at Chicago.

MARIA ALVI, MHA
Role: ACS Trauma Program Staff (TSC Logistics Manager and TSC Report Editor)

Ms. Maria Alvi joined the American College of Surgeons (ACS) Trauma Department as the Trauma Systems and Quality Programs Manager in May 2015. In this role, Ms. Alvi provides administrative support to the COT subcommittees within the Trauma Systems Pillar, and is the point of contact for the Trauma Systems Evaluation and Planning Committee. She also serves as the manager for the Trauma Systems Consultation Program, the BIS Facilitation Program, and other Trauma Systems and Quality initiatives.

Prior to joining the ACS, Ms. Alvi worked as a healthcare consultant at the IBM Watson Health Truven Health Analytics company for 2 years, providing data reporting support to US clients, through the company's trademarked financial, marketing and clinical outcomes assessment programs. Her focus at Truven also allowed her to assist with critical analysis and validation of client data towards improving health outcomes in their patients, and better management of their healthcare programs.

In December 2013, Ms. Alvi earned her Masters of Healthcare Administration (MHA) from the University of Illinois at Chicago, School of Public Health, Division of Health Policy and Administration. As part of her curriculum, she also completed a Graduate Preceptorship at Cook County Health and Hospitals System (CCHHS). Through this opportunity, Ms. Alvi employed strategic planning, process improvement, and operations management skills to clinical service-lines and non-clinical initiatives at John H. Stroger Hospital of Cook County and CCHHS.

Although interested in clinical sciences (pre-med curriculum), and licensed as an EMT-B for the State of Illinois until June 2012, Ms. Alvi found her passions truly lay within business management for healthcare services. She is passionate about helping clinical care providers as much as patients, in order to ensure quality and accessible care. Ms. Alvi serves as a volunteer member on the ACHE CHEF Communications Committee, is a Young Professional member for the Chicago Council on Global Affairs, and partakes in various early careerist, networking and charitable events throughout the greater Chicago area. Through her work at the ACS, Ms. Alvi also volunteers as a Bleeding Control (B-Con) Course Instructor which teaches life-saving skills to lay persons at the scene of an injury, and members of the public.

APPENDIX D: State Participants List

Name	Organization
Saman Arbabi	EMSTS Committee, and Harborview Medical Center
Tim Bax	Sacred Heart Medical Center
Melissa Belgau	State of Washington Department of Health
Anne Benoist	Western Region EMS and Trauma Care Council
Bob Berschauer	Member of the Public
Tony Bledsoe	State of Washington Department of Health
Benjamin Booth	State of Washington Department of Health
Tim Bricker	MultiCare Health System
Jennifer Brown	MultiCare Mary Bridge Children's Hospital
Eileen Bulger	Harborview Medical Center
Donna Bybee	State of Washington Department of Health
Brian Cain	MultiCare Health System
Christy Cammarata	Regional Liaison for Central, North Central and East Regions
Carolynn Cartwright	Redi Healthcare Coalition
Christine Clutter	St. Luke's Rehabilitation Institute
Rinita Cook	North Central Region EMS & TraumaCare Council
Eric Cooper	Providence Hospital
Rachel Cory	Central Region EMS and Trauma Care Council
Peg Currie	Providence Eastern Washington, Sacred Heart Medical Center and Holy Family Hospital
Jacob Dalstea	Life Flight Network
Tyler Dalton	Skagit Valley Hospital
Becky Dana	University of Washington
Aimee D'Avignon	State of Washington Department of Health
Eric Dean	State of Washington Department of Health
Xin Yao deGrauw	State of Washington Department of Health
Ajit Deol	Kadlec Regional Medical Center
Laureen Driscoll	MultiCare Deaconess Hospital
Kimberly Droppert	Kitsap County Emergency Medical Services and Trauma Care Council
Jamie Emert	King County Emergency Medical Services
Dawn Felt	State of Washington Department of Health
Dolly Fernandes	State of Washington Department of Health
Janna Finley	Providence Medical Center Everett

Name	Organization
Mary Flick	Harrison Medical Center
Werdell Gabriel-Sales	PeaceHealth Southwest Medical Center
Michael Glen	Harborview Medical Center
Rick Goss	Harborview Medical Center
Kristy Gradel	MultiCare Allenmore Hospital
Hailey Green	North, Northwest, West, Southwest and South Central Regions
Lourdes Guzman-Villalva	University of Washington
Beki Hammons	Kadlec Regional Medical Center
Jenna Hannity	St Francis Hospital
Therese Hansen	State of Washington Department of Health
Betsy Harris	Tacoma Trauma Trust
Denise Haun-Taylor	Peace Health Southwest Medical Center & TAC Chair
Joseph Hoffman	Kitsap County Emergency Medical Services and Trauma Care Council
Rhonda Holden	EMSTP Steering Committee
Catie Holstein	State of Washington Department of Health
Jim Jansen	State of Washington Department of Health
Brian Johnson	Harborview Medical Center
Jennifer Keim	University of Washington
Mary King	Harborview Medical Center, Seattle Children’s Hospital
Conor Klewend	Harborview Medical Center
Catherine Kustra	Confluence Health
Heather Lee	University of Washington
Onora Lien	Northwest Healthcare Response Network
Michael Lopez	Spokane Fire Department
David Lynde	Yakima County EMS & Trauma Care Council
Sam Mandell	Harborview Medical Center
Denise McCurdy	Providence Sacred Heart Medical Center and Children's Hospital
Alisha Mendes	University of Washington
Elizabeth Molina	State of Washington Department of Health
Merilyn Moore	University of Washington
Carolynn Morris	MultiCare Health System
Ingrid Mungia	MultiCare Health System
Jim Nania	Medical Program Director EMS, MultiCare Deaconess Hospital

Name	Organization
Anne Newcombe	State of Washington Department of Health
Martina Nicolas	North Region EMS & Trauma Care Council
Jason Norris	State of Washington Department of Health
Tim Orcutt	State of Washington Department of Health
Norma Pancake	Prairie County Emergency Medical Services
Tammy Pettis	Virginia Mason Memorial Yakima Hospital
Julie Rabeau	Member of the Public
Tom Rae	Member of the Public
Sharon Rainer	MultiCare Valley Hospital
Adam Richards	East Region EMS & Trauma Care Council and Providence Health
Wendy Rife	Providence Health
Leah Salmon-Conroy	MultiCare Deaconess Hospital
Michael Sayre	Seattle Fire Department
Karly Schriever	PeaceHealth
Max Sevareidis	NHTSA Office of EMS/ Department of Transportation
David Sewell	Multicare Deaconess Hospital
Nicole Siegel	Seattle Physical Therapist
Becky Stermer	PeaceHealth St. Joseph Medical Center
Susan Stern	Harborview Medical Center
Marc Taylor	Harborview Medical Center
Karen Thomas	Summit Pacific Medical Center
Tracy Timmons	PeaceHealth Southwest Medical Center Trauma Services
Ceasar Ursic	Trauma Trust
Monica Vavilala	University of Washington
Nathan Weed	State of Washington Department of Health
Hollie Weiberg	Summit Pacific Medical Center
John Wiesman	State of Washington Department of Health
Zita Wiltgen	Southwest Region EMS & Trauma Care Council

Appendix E: Focused Analysis Reference List

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Appendix F: Calculation of Min/Max Estimates from US Experience

Calculation of Min/Max Estimates from US Experience

Population Coverage Alone:

Assume the minimum number of high-level trauma centers (Level I, Level II, selected Level III) will be based on population coverage of 1,000,000 per center, using the Washington trauma region as the service area. This does not imply that 1 center per 1,000,000 people is a best practice for minimum coverage, or that the best functional service area is a single trauma region. These parameters should be adjusted based on local data, experience, established practice patterns, and stakeholder-driven policy regarding the balance between centralization to a few high-volume centers and increased system surge capacity provided by distribution of patients between a larger number of lower-volume centers.

Assume the maximum number of high-level trauma centers (Level I, Level II, selected Level III) will be based on population coverage of 250,000 per center, using the Washington trauma region as the service area. This does not imply that 1 center per 250,000 people is a best practice for maximum coverage, or that the best functional service area is a single trauma region. These parameters should be adjusted based on local data, experience, established practice patterns, and stakeholder-driven policy regarding the balance between centralization to a few high-volume centers and increased system surge capacity provided by distribution of patients between a larger number of lower-volume centers.

Example – West Region:

Estimated 2014 population – 1,240,000

(Derived from GIS-based model utilizing 2014 population in census tracts whose geographic centroid lies within the map boundaries of the West Region)

Estimated Minimum – 1,240,000/1,000,000 = 1

Estimated Maximum – 1,240,000/250,000 = 5

Use of Estimated Trauma Center Capacity

Estimate the number of patients likely to require a trauma center in the service area (assumed to be a trauma region) based upon Washington registry data for patients transferred from the scene. If no registry data is available, the number of patients could be estimated from raw population and epidemiologic data estimating rate of trauma center admission derived from national experience (CDC data) or administrative data. (This value is probably in the range of 6-7%).

Assume the minimum number of trauma centers (Level I, Level II, selected Level III) will be based on trauma center capacity (trauma admissions per 100 beds) equal to the 75%ile of Level I trauma centers reporting to the NTDB in 2015 (518 trauma patients per 100 beds). The number of centers will be determined by the number of available centers that will provide coverage for the estimated number of patients likely to require a trauma center calculated

above. This does not imply that trauma center capacity at the 75%ile of national data is a best practice for minimum coverage, or that the best functional service area is a single trauma region. These parameters should be adjusted based on local data, experience, established practice patterns, and stakeholder-driven policy regarding the balance between centralization to a few high-volume centers and increased system surge capacity provided by distribution of patients between a larger number of lower-volume centers.

Assume the maximum number of trauma centers (Level I, Level II, selected Level III) will be based on trauma center capacity (trauma admissions per 100 beds) equal to the 25%ile of Level I trauma centers reporting to the NTDB in 2015 (257 trauma patients per 100 beds). The number of centers will be determined by the number of available centers that will provide coverage for the estimated number of patients likely to require a trauma center calculated above. This does not imply that trauma center capacity at the 25%ile of national data is a best practice for minimum coverage, or that the best functional service area is a single trauma region. These parameters should be adjusted based on local data, experience, established practice patterns, and stakeholder-driven policy regarding the balance between centralization to a few high-volume centers and increased system surge capacity provided by distribution of patients between a larger number of lower-volume centers.

Example – West Region:

Number patients transported from the scene per year (from registry data) – 5,710

Existing West Region Centers

Hospital	Level	Beds	Est Annual Admissions at 25%ile	Est Annual Admissions at 75%ile	Actual Trauma Admissions	Actual Trauma Admissions/100 beds
1	II	240	617	1243	266	55
2	II	405	1040	2098	1174	67
3	II	305	784	1580	1017	192
4	III	112	288	580	449	524
5	III	275	707	1425	748	185
6	III	343	882	1777	866	65

Assessing this data, the three existing level II operating at 75%ile capacity would serve an estimated 4,921 patients, and that this gap could be filled by increasing capacity at a single hospital. All six existing hospitals operating at 25%ile capacity would serve an estimated 4,318 patients, and there would be potential room to add at least one and perhaps two hospitals at 25%ile capacity. This would yield an estimated minimum value of 3 and a maximum value of 7 or 8.

This analysis also points out that all but one of the existing centers currently operate at a capacity below the 25%ile on a national basis, suggesting significant extra capacity exists in the existing system.

This analysis does not take into account the effect of transfers, either from lower level to higher level centers, nor does it account for patients transported directly to hospitals outside the region. Both effects are difficult to measure or model, and add another layer of complexity to the

estimation of capacity needed in the region. This highlights the necessarily imprecise nature of these estimations.