A reassessment of the impact of trauma systems consultation on regional trauma system development

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Reviewer Disclosures: The reviewers have nothing to disclose.

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Submitted: August 25, 2014, Revised: February 8, 2015, Accepted: February 23, 2015.
From the Trauma Systems Evaluation and Planning Committee, American College of Surgeons' Committee on Trauma, Chicago, Illinois.
This study was presented at the 73rd Annual Meeting of the American Association for the Surgery of Trauma, September 9–13, 2014, in Philadelphia, Pennsylvania.
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DOI: 10.1097/TA.0000000000000653

BACKGROUND: Previous studies have shown that trauma systems decrease morbidity and mortality after injury, but progress in system development has been slow and inconsistent. This study evaluated the progress in 20 state or regional systems following a consultative visit conducted by the Trauma Systems Evaluation and Planning Committee (TSEPC) of the Committee on Trauma, expanding on a previous study published in 2008, which demonstrated significant progress in six systems following consultation.

METHODS: Twenty trauma systems that underwent TSEPC consultation between 2004 and 2010 were studied. Status was assessed using a set of 16 objective indicators. Baseline scores for 14 regions were calculated during the consultation visit and taken from the 2008 study for the remaining six. Postconsultation status was assessed during facilitated teleconferences. Progress was assessed by comparing changes in indicator scores.

RESULTS: There was significant improvement in approximately 80% of systems evaluated within 60 months following the consultation. There was no progress in five of six systems reevaluated over 80 months after consultation, and all four systems evaluated over 100 months after consultation showed erosion of progress. Significant improvements were seen in 10 of the 16 individual indicators, with the greatest gains related to system standards, data systems, performance improvement, prehospital triage criteria, and linkages with public health. Consistent with the 2008 study, the two indicators related to financing for the trauma system showed no improvement.

CONCLUSION: The TSEPC consultation process continues to be associated with improvements in trauma system development in approximately 80% of cases, consistent with the 2008 study, but gains are not self-sustaining. There was a stagnation in progress and a deterioration in total score over time, suggesting that a repeat consultation may be beneficial. System funding remains a challenge and was the area most likely to suffer setbacks over during study period. (*J Trauma Acute Care Surg*. 2015;78: 1102–1110. Copyright © 2015 Wolters Kluwer Health, Inc. All rights reserved.)

LEVEL OF EVIDENCE: Care management study, level V.

KEY WORDS: Trauma systems; assessment.

Injury is a problem of global proportion. Worldwide, road traffic injuries are the leading cause of death in the young (aged 15–29 years), responsible for more than a million deaths annually.[1] Within the United States, trauma remains the leading cause of death for persons younger than 45 years and among the top 10 causes for all decades of life.[2] It is responsible for almost a third of all potential years of life lost and generates a significant economic burden annually.[3] During the past four decades, numerous articles have documented the efficacy of trauma systems as measured by mortality,[4–7] morbidity,[8] quality of care,[9,10] economics,[11–13] and value.[14,15] Despite these findings, progress toward comprehensive regional systems of trauma care has been slow, and a high degree of variability exists with respect to essential system elements such as definitive care, emergency medical service (EMS), statutory authority, leadership, injury epidemiology, planning, funding,[16] and integration.[17] State and regional trauma systems have been hampered by a lack of federal leadership and support,[18] dwindling state resources, high staff turnover in lead agencies, political pressures, and legal challenges. Without federal leadership, the development of trauma systems and the processes and metrics to effectively compare them across differing regions has been challenging, and the responsibility for system development has fallen largely on state governments, those that are highly variable with respect to resources and political will.

On a national scale, the result is a highly variable patchwork of injury care capability, with significant geographic differences with regard to the development and maturity of policies, guidelines, infrastructure, and funding to implement these essential system elements. Ultimately, patient outcome may depend as much on the particular geographic location where their injury occurs as on the nature and severity of the injuries sustained.[19]

The American College of Surgeons (ACS) began offering trauma system consultations to states and regions in 1999. The purposes of these consultations are to describe a state or regional trauma system's developmental status across a number of categories, to conduct a gap analysis, and to make recommendations to assist the state or region in moving toward a more effective and efficient system, with the expectation that this will improve care for injured patients in the region. The consultation process does not benchmark against external standards because such standards do not currently exist, and given the marked heterogeneity of geographic regions, it is unlikely that a single set of benchmarks is universally applicable. Furthermore, the process is not an assessment of the function of the lead agency. The process is intentionally structured to be collaborative, seeking to generate consensus among stakeholders and to identify potential areas for progress and development. Every effort is made to empower lead agencies to steward change within a political environment, a process that is generally impeded by the assignment of a "grade." To date, more than 35 such consultations have been completed.

The ACS Trauma Systems Consultation program began to assess progress made by trauma systems visited after 2004. The tool used was a 16-item subset of the Benchmarks, Indicators, and Scoring (BIS) tool published in the Health Resources and Services Administration (HRSA) 2006 *Model Trauma System Planning and Evaluation* (MTSPE) document. Although published under the auspices of HRSA, the document was the result of a collaborative effort to encapsulate current expert consensus regarding the high-level principles governing optimal trauma system design. Driven by an understanding that the challenges facing each region are unique, the MTSPE document is focused at a high strategic level and does not provide prescriptive advice or outline expected operational practices. Instead, it was intended to provide a framework of globally applicable principles, with the understanding that all tactical solutions would be achieved at the local level. The full set of more than 100 BIS indicators was conceived as a tool for self-assessment, to be used by an

TABLE 1. Subset of Indicators for System Evaluation

Section 100: Assessment
Benchmark 101. There is a thorough description of the epidemiology of injury in the system jurisdiction using both population-based data and clinical databases.
Indicator 101.2. There is a description of injuries within the trauma system jurisdiction including the distribution by geographic area, high-risk populations (pediatric, elder, 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, emergency department data, EMS data, hospital discharge data, state police data (those from law enforcement agencies), medical examiner data, trauma registry, and other data sources. The description is updated at regular intervals.
Benchmark 102. There is an established trauma management information system for ongoing injury surveillance and system performance assessment.
Indicator 102.2. Injury surveillance is coordinated with statewide and local community health surveillance.
Indicator 102.3. Trauma data are electronically linked from a variety of sources.
Section 200: Policy Development
Benchmark 201. Comprehensive state statutory authority and administrative rules support trauma system leaders and maintain trauma system infrastructure, planning, oversight, and future development.
Indicator 201.4. The lead agency has adopted clearly defined trauma system standards (e.g., facility standards, triage and transfer guidelines, and data collection standards) and has sufficient legal authority to ensure and enforce compliance.
Benchmark 203. 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.
Indicator 203.1. The lead agency, in concert with a trauma-specific multidisciplinary, multiagency advisory committee, has adopted a trauma system plan.
Indicator 203.4. 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.
Benchmark 204: Sufficient resources, including those both financial and infrastructure related, support system planning, implementation, and maintenance.
Indicator 204.2 Financial resources exist that support the planning, implementation, and ongoing management of the administrative and clinical care components of the trauma system.
Indicator 204.3 Designated funding for trauma system infrastructure support (lead agency) is legislatively appropriated.
Benchmark 208: The trauma, public health, and emergency preparedness systems are closely linked.
Indicator 208.1 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.
Section 300: Assurance
Benchmark 301: The trauma management information system 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.
Indicator 301.1. 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.
Section 300: Assurance
Benchmark 302: 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.
Indicator 302.1. 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.
Indicator 302.6. There are mandatory systemwide 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 the major trauma patient.
Benchmark 303: Acute care facilities are integrated into a resource-efficient, inclusive network that meets required standards and that provides optimal care for all injured patients.
Indicator 303.1. 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 (e.g., burn, pediatric, spinal cord injury, and others).
Benchmark 307: To maintain its state, regional, or local designation, each hospital will continually work to improve the trauma care as measured by patient outcomes.
Indicator 307.1. The trauma system engages in regular evaluation of all licensed acute care facilities that provide trauma care to trauma patients and designated trauma hospitals. Such evaluation involves independent external reviews.
Benchmark 308: 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.
Indicator 308.1. The lead agency has incorporated, within the trauma system plan and the trauma center standards, requirements for rehabilitation services including interfacility transfer of trauma patients to rehabilitation centers.
Benchmark 311: The lead agency acts to protect the public welfare by enforcing various laws, rules, and regulations as they pertain to the trauma system.
Indicator 311.4. Laws, rules, and regulations are routinely reviewed and revised to continually strengthen and improve the trauma system.

individual region. The 16-element subset of indicators used in this study was specifically chosen with the intent to provide a broad overview of system status. The chosen indicators assess large elements of system structure and function that are well beyond the immediate control of the lead agency or individual stakeholder groups. The consultation process does not directly target these particular indicators and is not tailored to raise specific scores. The indicator scores are expected to rise with the overall level of system development.

In 2008, an assessment of the impact of six trauma system consultations conducted between 2004 and 2006 was published.[20] This study showed that system consultations were associated with improvements in five of the six systems evaluated. Although progress was strong in areas of system design and planning, the consultative process did not seem to impact the ability to secure stable funding. The intent of this article was to follow up and expand on that 2008 study. The original 6 states/regions have had a second follow-up assessment, and 14 additional states have undergone an initial follow-up analysis. The hypothesis was that trauma systems consultation continues to be associated with improvements in system development, as measured by changes in the 16 indicator scores, and that these

TABLE 2. Progress Scoring for Indicators

Score	Progress Scoring
0	Not known
1	No development
2	Minimal development
3	Limited development
4	Substantial development
5	Full development

changes increase with the length of time elapsed since consultation, as found in the 2008 study.

MATERIALS AND METHODS

All trauma systems that had a consultation visit conducted by the Trauma Systems Evaluation and Planning Committee (TSEPC) between January 2004 and October 2010 were identified. Consultations performed before 2004 (not uniformly conducted in the same manner as those in the study group) and those performed after 2010 (minimum established follow-up period of 2 years not met) were excluded. Twenty-one consultations met inclusion criteria, but one was lost because of the inability to schedule a follow-up telephone conference despite multiple efforts. The remaining 20 systems constitute the study group.

With the use of a methodology previously described,[20] the level of trauma system development was assessed using a 16-element subset of the BIS assessment tool described in the MTSPE document released by the HRSA in 2006 (available at https://www.facs.org/quality-programs/trauma/tsepc/resources). The 16 indicators used are listed in Table 1, and the associated scoring system is presented in Table 2. For the six systems that had consultation visits before 2007, the follow-up scores from the 2008 study were used as baseline scores for the current evaluation. For the remaining 14 consultations performed after 2007, the consultation team assessed trauma system baseline scores prospectively at the time of the visit. Follow-up scores for all systems were assessed by a telephone conference including members of the original TSEPC consultation team and current key leaders of the trauma system. Follow-up calls were performed between January 2012 and September 2013. In addition to assessing follow-up scores for the individual indicators, system leaders were also asked about the priority recommendations that had been made by the consultations team, the degree to which these recommendations had been implemented, and the reasons why.

An analysis appropriate for paired data was used. The value of each of the 16 indicators for each system was measured before consultation and at the follow-up call after consultation, and the difference between before and after scores was calculated. The sum of the 16 indicator scores for each system was taken as a measure of the overall level of system development before and after consultation, with a maximum possible score of 80. The average of the 16 indicator differences for each system was calculated and was used as a measure of system change over the evaluation interval. The distribution of indicator differences was qualitatively evaluated by inspection of the histograms, Q-Q quintile plots, and skewness/kurtosis values, and the distributions seemed to be sufficiently normal to allow the use of the Student's t test. Differences in average indicator scores were compared using a two-tailed Student's t test, with statistical significance assumed for $p < 0.05$.

RESULTS

Twenty trauma systems were included in the analysis. The time interval between the baseline assessment and follow-up call ranged from 3 years to 9 years. For the six systems originally studied, the evaluation was the second one, and the time elapsed since initial consultation was 8 years to 9 years. For these systems, the first evaluation was performed approximately 2 to 3 years after consultation in four cases and approximately 1.5 years after consultation for the other two. For the remaining 14 systems that were evaluated for the first time, the time elapsed since initial consultation was approximately 3 years to 5 years. The sums of the 16 indicator scores for each system and the interval change are shown in Table 3. The average change in the 16 indicators for each system is shown in Table 4. Of the 14 systems having their first follow-up review, 11 (79%) showed statistically significant progress in trauma system development as measured by average change in the 16 BIS indicators, compared with 5 of 6 systems (83%) evaluated in the initial study. These 14 systems also showed the largest changes in the sum of their

TABLE 3. Change in Sum of 16 Indicator Scores by System (Sorted by Net Change in Indicator Score)

System ID	Sum of Baseline Scores	Net Change	Sum of Follow-up Scores	Follow-up Interval, mo
1	32	37	69	38
2	30	34.5	64.5	44
3	27	26.5	53.5	44
4	32	26	58	45
5	32	25	57	47
6	28	25	53	42
7	27	22	49	50
8	39.5*	22	61.5	77
9	40	20	60	52
10	33	18	51	40
11	20	11	31	56
12	32*	9.5	41.5	77
13	20	6.5	26.5	33
14	48	0	48	57
15	32	0	32	48
16	20	−1	19	43
17	50.5*	−2	48.5	77
18	52*	−6	46	76
19	51*	−7.5	43.5	76
20	35.5*	−9.5	26	76

*Follow-up score from the 2008 study used as the baseline.

TABLE 4. Average Change of 16 Indicator Scores by System

	Data From 2008 Study			Data From Current Study			Interval
System ID	Average Change	SD	*p*	Average Change	SD	*p*	Months
1				2.313	0.998	0.000	38
2				2.156	0.831	0.000	44
3				1.656	1.72	0.002	44
4				1.625	1.258	0.000	45
5				1.563	1.094	0.000	47
6				1.563	1.124	0.000	42
7				1.375	1.408	0.001	50
8	1.12*	0.719	<0.001	1.37**	0.866	0.000	77
9				1.25	1.438	0.003	52
10				1.125	1.088	0.000	40
11				0.688	0.873	0.007	56
12	0.12*	1.147	0.669	0.469**	1.04	0.091	77
13				0.406	0.612	0.018	33
14				0.00	1.461	1.00	57
15				0.000	1.111	1.00	48
16				−0.063	0.574	0.669	43
17	1.81*	1.05	<0.001	−0.125**	0.671	0.467	77
18	1.19*	1.276	0.002	−0.375**	1.335	0.279	76
19	1.5*	1.211	0.000	−0.469**	1.36	0.188	76
20	1.0*	1.211	0.005	−0.594**	1.497	0.133	76

*Change between baseline and reassessment performed for the 2008 study.
**Change between reassessment performed for the 2008 study and reassessment performed for the current study.

indicator scores. Of the six states having their second follow-up review, only one showed continued statistically significant improvement, while four showed a trend toward degradation of their indicator scores.

The changes in average score for each individual BIS indicator across the 20 systems studied are reported in Table 5. In the 2008 study, the systems showed statistically significant improvements in 14 of the 16 BIS indicators. Two indicators, both of which were related to system funding (204.2, 204.3), did not show improvement. In the current study, systems showed a significant improvement in 10 of 16 indicators. Two of the indicators that remained unchanged were the same ones related to system funding that failed to show improvement in the 2008 study. The four additional measures in which systems failed to show improvement included three related to trauma system planning (203.1, 203.4, and 303.1). The fourth indicator was related to prehospital trauma triage (302.6).

In subset analysis, systems scoring 3 or higher on an indicator related to financing (204.2) were compared with those scoring less than 3 (Table 6). Although states with higher scores on the funding indicator had slightly higher average change in indicator scores, these findings were not statistically significant. The effect of time elapsed between consultation and follow-up assessment was also evaluated. In contrast to the initial study, there seems to be a stagnation of progress and a trend toward degradation of scores as the time from the initial consultation goes beyond approximately 60 months.

DISCUSSION

In this study, trauma system consultations continue to be associated with progress in state and regional trauma system development. The percentage of systems showing statistically significant positive changes (79%) was comparable to the percentage showing positive change in our original study (83%). The systems that made progress had widely varying geographic and demographic characteristics but were similar in that all had shown sufficient motivation to arrange for and fund the trauma system consultation and all had shown ongoing efforts to act on the recommendations of the consultation team. The current data do not support any causal relationship between the progress in system development and the consultation visit or between progress and other system characteristics. The three systems that failed to make progress during the follow-up period were likewise at varying levels of initial development (as measured by the sum of the baseline indicator scores) and had widely varying geographic and demographic characteristics. The current data do not support any conclusions regarding the reason these systems failed to make progress, but possible explanations include differences in system leadership structure, varying levels of system funding, and differences in economic climate.

In our 2008 study, there was a trend toward improved indicator score in systems that had a longer period between their consultation visit and the reassessment call. The present study also showed improvement in indicator scores during the first few years after consultation. In contrast, the present study shows a statistically significant decrease in mean indicator change in systems with a longer elapsed time between consultation and follow-up assessment (Fig. 1). The six states originally studied form a cluster with elapsed time between consultation and follow-up of 90 months and 110 months, and five of the six showed no change or a decrease in mean indicator change. Four of four systems with elapsed time over 100 months showed

TABLE 5. Average Change in Individual Indicators

	2008 Study Data (6 States)			Current Data (20 States)		
Indicator	Mean	SD	*p*	Mean	SD	*p*
101.2	0.975	1.106	0.000	0.725	0.85	0.001
102.2	1.175	1.28	0.000	0.975	1.251	0.002
102.3	1.325	1.228	0.000	0.975	1.313	0.004
201.4	1.8	1.39	0.000	1.325	1.533	0.001
203.1	0.85	1.488	0.02	0.275	1.391	0.387
203.4	0.775	1.33	0.02	0.2	1.517	0.562
204.2	0.325	1.649	0.39	0.325	1.389	0.308
204.3	0.425	1.83	0.31	0.325	1.672	0.396
208.1	1.45	0.872	0.00	0.975	1.045	0.000
301.1	1.6	1.095	0.00	1.1	1.41	0.002
302.1	0.925	1.249	0.004	0.675	1.115	0.014
302.6	1.075	1.301	0.001	0.65	1.396	0.051
303.1	0.95	1.347	0.005	0.45	1.53	0.204
307.1	1.825	1.28	0.000	1.625	1.468	0.000
308.1	1.15	1.396	0.002	0.85	1.763	0.044
311.4	1.65	1.424	0.000	1.3	1.593	0.002

TABLE 6. Average Change of 16 Indicator Scores Systems Grouped by Score on Indicator 204.2 Related to System Funding

Funding Group	n	Average Change	SD
204.2 ≥ 3	13	1.31	0.7942
204.2 < 3	7	0.830	0.2510
$p = 0.191$			

negative mean indicator change. These systems were also heterogeneous with respect to geographic, demographic, and structural characteristics, so no conclusions could be reached as to the cause. The stagnation and even backward movement in system evolution may be caused by a loss of focus on system development or the fact that the changes that are practical and achievable have already been implemented. It is also possible that the list of recommendations begins to lose relevance with the passage of time. In any case, this finding suggests that the entire process of trauma system development should be viewed in a different light and offers insight into the lack of long-term progress that has characterized the process in most regions during the past 30 years.

The development and operation of a regional trauma system is a complex task, requiring prolonged cooperation among a large and diverse group of stakeholders. Issues such as leadership turnover, personnel changes within key stakeholder groups, and failure to reach consensus regarding controversial system decisions can cause system dysfunction while shifting energy and attention away from planning and implementation of system improvements. These were also reasons cited by system leaders for the inability to fully implement priority recommendations made by the consultation team.

Several external factors that have affected trauma system development have further contributed to an environment that is not conducive to consistent progress. The first is limited federal leadership to guide trauma system development across the United States. The HRSA's Trauma and EMS Program, although continuously authorized, has not been appropriated (funded) since 2005. During the ensuing decade, states and territories found it difficult or impossible to backfill the small but important loss of federal funding during difficult economic times. Furthermore, the lack of federal leadership and coordination of system development has left the evolution of trauma systems to the state or county governments by default. There is a wide disparity between regions in terms of political will, leadership stability, and financial resources, which has resulted in widely divergent approaches. These factors were also echoed by system leaders in the context of implementation of priority recommendations. Federal leadership, support, and coordination of trauma system development are beneficial, as demonstrated by the number of states actively addressing trauma systems when such supports were available. Federal guidance is also probably needed given the challenges that individual regions face in implementing potentially controversial policy decisions. Such federal leadership and support need not and likely should not involve the establishment of specific structures and procedures but rather can be effective by linking federal funding to compliance with high-level principles, along the lines of programs such as Medicaid.

When looking forward, the ability to evaluate and improve systemwide performance and outcomes will become increasingly important in a pay-for-performance environment. The observation that approximately 80% of systems made statistically significant progress in the first few years after consultation, in both the 2008 study cohort and the current one, suggests that the consultative process is of value in helping systems reenergize stakeholders, refocus their energy, and make progress working with an updated list of priority recommendations. Seen in this way, the process of external expert review and consultation is most likely to be successful not as a single static event but as an ongoing and dynamic process that is repeated on a regular basis, adapting approaches and recommendations to changing circumstances.

Limitations to this study's methodology were discussed in detail in the 2008 article;[20] however, it is important to point out again that no causal relationship between the visit and improved indicator scores can be demonstrated and there was no control group of trauma systems without a consultation. Factors including the economic and political climate also affect trauma system development and represent possible confounding elements; however, consultations and evaluations were made under both good and bad economic conditions and differing political climates, and there was no clear trend. Some systems made progress under adverse conditions, while others were stagnant under better conditions. Furthermore, the BIS indicators have never been fully validated; the BIS indicators focus on structure and process measures modeled within a public health framework but cannot be directly tied to patient outcomes. In addition, some degree of imprecision and variability is inherent in a semiquantitative consensus methodology.

The trauma system consultation process provided by the TSEPC continues to be associated with improvements in the level of development of state and regional trauma systems as measured against a selected set of 16 indicators. The

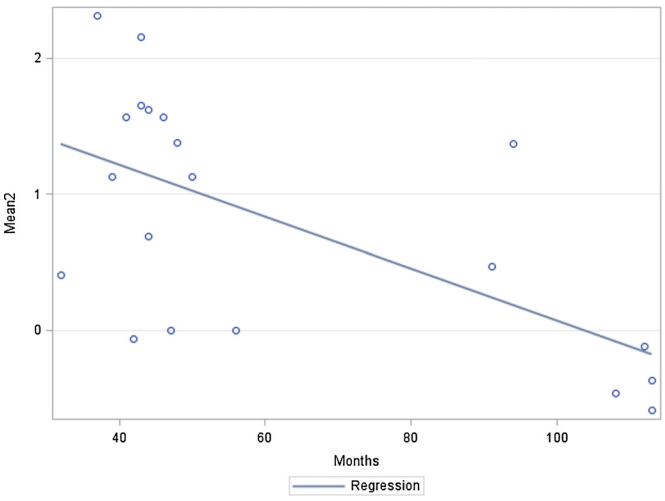

Figure 1. Average indicator change by system plotted against time since consultation visit.

percentage of systems showing an improvement after consultation has remained constant during the past 10 years, despite significant changes in the socioeconomic factors that affect health care. The positive changes cannot be causally attributed to any specific characteristics of the consultation process, and the focused stakeholder involvement and attention generated by the consultation process may be one of the key factors. The improvements associated with the consultation visit seem to erode with the passage of time, and beyond a period of 90 months, the majority of systems seem to be losing ground previously gained. This suggests that a process including regular follow-up consultations or other activities that serve to reengage and reenergize stakeholders may be an important way to promote ongoing progress. Additional study is warranted to validate the BIS measurement instrument, to link aggregate and individual BIS measures to system performance outcomes, and to determine more precisely the optimum timing for repeat consultation visits or other reevaluation and revisioning activities.

AUTHORSHIP

R.J.W., N.D.S., J.B., and H.M. contributed in the conceptual design, data collection, data analysis, and manuscript preparation. C.R.K., R.G., and T.J.E. contributed in the data collection and manuscript preparation. H.S. performed statistical analysis and manuscript review.

DISCLOSURE

R.J.W. is a fellow of the ACS and chair of the TSEPC of the Committee on Trauma. C.R.K., R.G., and T.J.E. are fellows of the ACS and members of the TSEPC. N.D.S., H.M., and H.S. are employees of the ACS and staff of the TSEPC. J.B. is a consultant to the TSEPC. All authors except H.S. have been members of TSEPC consultation teams involved with the systems included in this study. All authors except H.M. and H.S. have received honoraria from the ACS for their participation in TSEPC consultation teams.

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DISCUSSION

Dr. Richard Mullins Mullins (Portland, Oregon): The authors and the other members of the trauma system evaluation and planning committee deserve congratulations on a number of fronts. First, they developed an innovative program, or method, for evaluating a statewide trauma system. That was a lot of work. Additionally they have used measures to evaluate changes over years in the operation of implemented statewide trauma systems. Thus they are able to report in this manuscript that changes in state's trauma systems have occurred, and improvements may be related to trauma system consultation program. Congratulations on an innovative outcome study.

An important finding in this paper is that trauma systems are not static, but rather dynamic, adapting to changes. It is misleading for us to think that if a statewide trauma system is implemented, all the work is done, and you can expect it will just continue unmodified and fully operational. The authors identify a number of factors that influence change: budgets, political will, and the changing pattern of injured patients—for example, they are getting older. I have three questions.

Dr. Winchell, what is the reliability of the scoring system-your benchmark indicator scoring system? Dr. Winchell described to us his evaluation teams' methods; the group listens on the phone to a report from the state's trauma system administrators, and after the administrators hang up, the trauma system evaluation team, the three committee members, discuss the findings and negotiate until they agree on a single numbered score assigned to each one of the 16 indicators.

An alternative method would be to have a blind vote of the three members and determine the standard deviation of assigning the score and include that in your statistical analysis. I'm not criticizing what you are doing, but I am wondering was there times when the three reviewers had difficulty reaching an agreement? Can you provide us a measure of inter-rater reliability on the three members' first vote?

My second question is a policy issue. Your committee used national standards, those 16 standards abstracted from the HRSA proposals. Why is it that the federal government should be allowed to determine whether my trauma system in Oregon or yours in Maine, now in Texas, is doing a good job or not?

The message of this manuscript is if you are a state where the indicator scoring system's score goes up over years, you are doing better. If your are in a state where the score decline, your state has deteriorated in its commitment to trauma systems. In my opinion, states should decide health care policy that is tailored to their needs. We all know there are blue states and red states. We know that not every state signed up for the Affordable Care Act.

Therefore it seems reasonable to expect a lot of variation among states as to how much they will invest in support of trauma systems. My question, Dr Winchell, is what rationale can you provide us that it is appropriate to use federal HRSA standards in categorizing the quality and effectiveness of an individual state's trauma system?

My last question is related to the trend over the past few years that more of the non-trauma emergency surgery is being done by trauma surgeons on trauma call in trauma centers. This is what Dr. Jurkovich and the others wanted us to do: trauma surgeons to metamorphose into acute care surgeons.

Has your committee in its consultation work endorsed the acute care surgery model? Are you telling states they ought to anticipate that their statewide trauma system will one day become a statewide acute care surgical system?

Thank you very much for the opportunity to discuss this paper.

Dr. Frederick Moore (Gainesville, Florida): I've had the pleasure of participating as a local trauma surgeon in two ACS COT Trauma Systems Consultations, one when I lived in Texas and then most recently after I moved in Florida. In both cases I was amazed that the review panels could comprehend these complex state trauma systems in the two-day review period and then offer constructive recommendations I found the system consultations that I was involved in were very educational for me to understand my statewide trauma systems. But to get to the question, in both instances there was a local problem headed on a disastrous course, and provided the rationale for our Departments of Health to pay the $50,000 fee to have an ACS COT Systems Consultation visit. So I assume that some of the changes that you are seeing are simply because of a perceived disaster and the consultation visit is an opportunity to get all the stakeholders together to effect a change. What do you think of that idea that most of the early changes were due to this type of halo effect?

Dr. H. Gill Cryer (Los Angeles, California): I enjoyed your paper and I think the thing that struck me about it was your last line about inability to measure outcome. And it just seems to me that we have the technology to do that now, we have the means with TQIP doing system reports.

At least three state systems—Georgia, Michigan and Arkansas—already have some sort of a relationship with TQIP that gives them risk-adjusted outcomes. I just don't see how you can go forward with your committee's work, which is a tremendous amount of work and involves getting buy-in from people who just don't want to do it and that's really important to do. But why not just make it imperative that the risk-adjusted data be obtained by state trauma systems so that you can have that third pillar in your armamentarium?

Dr. Ronald M. Stewart (San Antonio, Texas): First, I would congratulate you, Dr. Winchell, and your entire time on the systems committee for a great paper and tremendous work.

I guess the systems consultations are voluntary, as the systems committee has to be asked to come visit, which is the way it works, voluntary. And it's a consultation.

You have convinced me, and I think if you look at outcomes data that we have across the country from a variety of different sources, it appears with increasing trauma system development that mortality decreases over time.

So I think we have enough information to say that, if you have a system consultation visit, it looks like these outcomes improve, and we have data from other sources that show that with trauma systems implementation mortality does improve.

Do you think there is any merit or benefit at some point in time if we ask for the American College of Surgeons to come visit a region and do a site visit that it be more than a consultation-not just a consultation but, you know, acceptable or not acceptable, whatever the term would be used-do you think there is merit in that? Or do you think that would dissuade people from asking for the consultation?

Dr. Gregory J. "Jerry" Jurkovich (Denver, Colorado): I should let Ronnie Stewart as chairman of the COT go last since he does have the last word on the College verification visits.

My question involves the point you made about degradation of the response to the site visit, and the lack of responsiveness to the suggestions that were made during the site visit. Do you think you can subjectively quantify what you think are the most problematic areas of a site visit that aren't followed through on, or aren't listened to, or are the causes of degradation?

When you do a site visit—and your COT Committee has vast experience on this—what have been the areas most resistant to change? What are the parts of it that are most problematic to states or regions vis-a-vis the suggestions of your committee versus what they want to implement locally?

Dr. Robert J. Winchell (Portland, Oregon): Thank you, Dr. Mullins, for your insightful comments. To begin with, we did not do formal inter-rater reliability on the scoring system. In fact, we went to more of a group-think about it. The group-think actually involved the people we were evaluating, too; the ones on the phone would help.

Frankly, that was because the scoring system itself is just not that robust. It was put together with the best of intentions but the five points are not all that linear. Sometimes a four isn't necessary all that much better than a three. We thought that too

much statistics was overkill. And that, in fact, the consensus approach was probably the best we can do.

The BSS was originally intended to be a self-assessment—that it would be sent out to the stakeholders and to the people at an individual center or an individual system, and it would be filled out by everybody. We, in fact, facilitated BSS visits in some states to help them come together and help them identify what they perceive to be their own strengths and weaknesses within the system.

And certainly we're working to improve the BSS. There hasn't been anything done with it since 2006 from the HRSA standpoint. We're working to improve our individual 16 indicators and to put them in a web-based format along with additional metrics that will help us perhaps generate a better self-assessment.

So with respect to standards, I don't believe that there are national standards that can work. The trauma system document was built on broad principles.

A lot of the people in the room came from the AAST and the College. It was a consensus document that was, in fact, published by HRSA but not generated by them. And it has a very broad set of how you should run an inclusive trauma system and how it should fit into a public health strategy. If indeed it has a weakness, it is because it is at not the 50,000-foot but the 95,000 or 100,000-foot level sometimes.

And so I don't believe it really is involved with us taking or the government sort of taking a stance. It's much more about here are kind of the principles that look pretty good. At the same time, the whole report card idea is a very sensitive one. And if you will notice, the states and the regions were identified by numbers not by name. Part of our getting them to go along with this study included the fact that we wouldn't put anybody's score up there because it is a highly sensitive thing within Stadium S offices where people serve at the whim of the legislature and getting a bad grade may mean me getting another job.

With respect to acute care surgery, we have not addressed that topic at all, in fact have not seen that as within the purview of trauma systems, specifically. What we have done is attempted to suggest to people that trauma systems probably do have a natural integration with things that are otherwise under the "time-sensitive injury" moniker or "time-sensitive illness" moniker.

We suggest that they should be integrated, that the things that make a stroke network and the things that make an MI network all have a lot of similarities. But, again, our recommendations are at a much higher level than what the surgeons within an individual hospital are doing.

Dr. Moore, thank you very much for your kind comments. I will comment that when we went to Florida in our plenary session the first three people that got up were attorneys. That was a first and has been a last as well.

I think that your idea of how and why the system consultation works, I think in many ways it's almost more of a sociologic than a scientific phenomenon. It may, in fact, have been brought on by a sense of crisis and that there is something to be broken for people to bring us in. Often what we find is that it brings people together in the same room who may never have been in the same room before, even though they are all supposedly working on trauma systems. Perhaps you might argue that a lot of what we do has nothing to do with the recommendations we make but has to do with the fact that we forced everybody to get together and kind of talk about it.

Dr. Cryer, trying to come up with a set of outcomes and a set of metrics is the top priority of our committee right now. It's an incredibly challenging problem. If I can reference Florida, again, I think the epiphany I had about this never being a fully data-driven decision is when two very good researchers using completely acceptable statistical methods analyzing the same data stood up and presented diametrically opposite conclusions.

And so we can do something with the data. The outcomes are really important to try and come up with, but it's never going to get past the inherently local and political nature of how high is up and what is it that people really want to accomplish.

Dr. Stewart, along the same lines, I think it is going to be hard to ever say this is what you have to tow the line to and you've got a B instead of a C or an A. When you do that, what tends to happen is folks don't look at the C and say, "I need to get better." They say, "Why the heck didn't you give me an A? I deserved an A." And so it sort of sets the process up in a different way.

What we have done in a lot of our recent visits is change the focus from the strategic to the tactical. And we've gone back to certain places and gone to say, "Okay, we can help you solve this problem. Here is how five other states that look like you have done it." And maybe, you know, some of these will work, realizing, again, that Wyoming isn't Montana or California, and they're all a little bit different.

Finally, Dr. Jurkovich, I would say the reasons come down to two or three, mostly. Part of the reason why trauma systems haven't been pushed forward as fast as all of us should think is because, in fact, they are not static, they are dynamic. It's not, "Hey, we're done" back in '94 and that's that.

If you look at who is in place trying to actually make it happen they are Stadium S agencies, right? They have the budget of a third-world country. They're understaffed and they serve at the political whim of the government. Also, the turnover-people don't last. The institutional memory in the Stadium S office is variable, two or three years in some places is a good day. We've gone back to places where there is just literally no remnant of the people that we talked to on the previous time. That is a huge barrier.

As much as we in this room might accept that trauma is a huge public health problem, as Dr. Ashley suggested, a lot of the folks in the legislature don't see it that way. And so funding is the second huge barrier.

And I think the third reason that you run up against is just the stakeholders get frustrated and worn out, the people who have volunteers who have been beating their head against the problem for 30 years and don't necessarily see it getting anywhere. And, in fact, I think part of what we do is help pump some life back into the process.

Again, my thanks to the Association for the privilege.