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Impact of American College of surgeons trauma verification on statewide collaborative outcomes

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BACKGROUND:	American College of Surgeons (ACS) trauma center verification has demonstrated improved outcomes at individual centers, but its impact on statewide Trauma Quality Improvement Program (TQIP) Collaboratives is unknown. A statewide TQIP Collaborative, founded in 2011, noted underperformance in six of eight patient cohorts identified in the TQIP Collaborative report. We hypothesized that requiring ACS verification for level I and II trauma centers would result in improved outcomes for the state collaborative.
METHODS:	The ACS verification requirement was tied to ongoing Trauma Commission funding. Trauma centers were required to apply for an ACS consultative visit by 2017 and were given until 2023 to achieve ACS verification. The effect of this intervention was measured in the number of centers achieving verification and in the performance of the TQIP Collaborative semiannual reports.
RESULTS:	In 2015, only 1 of 15 (7%) trauma centers were ACS verified, and 4 had undergone consultative visits. By 2023, 11 of 12 (92%) trauma centers achieved ACS verification. Following this intervention, the observed-to-expected odds ratio for all-patient morbidity and mortality improved from 1.60 to 1.17, and variation among patient-specific cohorts narrowed from 0.97–1.82 to 0.96–1.48 (Figure 2). Performance in all six underperforming patient-specific cohorts improved over the study period.
CONCLUSION:	ACS verification for level I and II trauma centers improves TQIP Collaborative performance. Statewide Collaboratives should consider ACS verification as a requirement for participation. (*J Trauma Acute Care Surg.* 2025;00: 00–00. Copyright © 2025 The Author(s). Published by Wolters Kluwer Health, Inc. on behalf of the American Association for the Surgery of Trauma.)
LEVEL OF EVIDENCE:	Economic and Value-Based Evaluations, Level III.
KEY WORDS:	Trauma systems; American College of Surgeons Verification; American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP); collaborative quality improvement; trauma outcomes.

Over the last two decades, the Michigan Trauma Quality Improvement Program (MTQIP) has led the way in demonstrating that participation in a statewide collaborative promotes compliance with standards of care, improves outcomes, and reduces costs at participating centers.[1–4] Following the success of Michigan, our state's trauma centers began meeting collectively in 2011 to identify areas for system-level trauma center quality improvement. By 2016, the Georgia Trauma Commission, the state agency that serves as the accountability mechanism for the Georgia trauma system formally established the Georgia Trauma Quality Improvement Program (GQIP) to improve patient outcomes among Georgia's level I and II trauma centers.[5] Georgia has been fortunate to have a dedicated funding mechanism since 2010 through the Super Speeder law. A $200 fee is imposed on excessive speeding violations, 75mph and over on any two-lane road and 85mph and over on any roadway. In 2016, a secondary funding mechanism was added through a fireworks excise tax. Fifty-five percent of the revenues from the fireworks excise tax are allocated to the trauma system. Together, the Super Speeder fees and the fireworks tax provide about $22–23 M annually to the trauma system.

As part of our state's participation as a Trauma Quality Improvement Program (TQIP) Collaborative (inclusive of all Level I and II trauma centers), GQIP receives semiannual, risk-adjusted benchmark reports. The TQIP collaborative benchmark report can be trended to measure quality improvement over time. Early benchmark reports reflected significant underperformance across all patient cohorts for risk-adjusted major complications. In the initial analysis of the reports and discussion among GQIP

Submitted: August 5, 2024, Revised: September 17, 2024, Accepted: October 1, 2024, Published online: January 9, 2025.

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This article was presented as a podium presentation at the 83rd Annual Meeting of the AAST and Clinical Congress for Acute Care Surgery on September 11, 2024, in Las Vegas, Nevada.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text, and links to the digital files are provided in the HTML text of this article on the journal's Web site (www.jtrauma.com).

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DOI: 10.1097/TA.0000000000004505

participants, concerns about heterogeneity in data quality were raised. Efforts to improve data quality began early within GQIP. Attention to accurately capturing complications and comorbidities through implementing statewide audit filters to reduce heterogeneity were among the initial work products of GQIP. The audit filter efforts led to the creation of algorithms to enhance complication capture. Additional work around data quality included external data validation visits between centers and cohort drill-down exercises. Improvements in data quality were demonstrated by a reduction in error rates after implementing a standardized audit filter analysis for all GQIP participants.[6] Despite improvements in data quality, evidence of clinical underperformance persisted in subsequent reports.

American College of Surgeons (ACS) level I and level II trauma center verification has demonstrated improved hospital resource utilization and outcomes, with an overall cost reduction that provides a positive return on investment.[7,8] Even the process of preparing for an ACS verification site visit has demonstrated a marked increase in survival for severely injured patients, along with a reduced overall average length of stay.[8] There is, however, no literature on the effects of ACS verification on the overall performance of a statewide collaborative. With statewide and healthcare system collaboratives becoming more prevalent, a better understanding of the impact of ACS verification on collaborative performance may be helpful. We hypothesized that requiring ACS verification for level I and II trauma centers would decrease variation in performance and improve state collaborative outcomes.

METHODS

This project was conducted as an approved quality improvement project and received a letter of exemption from an Institutional Review Board. The findings are reported in accordance with the SQUIRE 2.0 Guidelines (Supplemental Digital Content, http://links.lww.com/TA/E191).[9] Semiannual TQIP collaborative reports for GQIP from Fall 2015 through Spring 2023 were used in the analysis. In 2016, the Georgia Trauma Commission instituted a requirement for all level I and II trauma centers to become ACS verified to be eligible for continued trauma center funding. Recognizing the complexity of achieving ACS verification across a trauma system, we implemented a stepwise approach. The first step was to require trauma centers to apply for an ACS consultative visit by 2017. Trauma centers received their ACS consultative reports, created corrective action plans, and were given until 2023 to achieve ACS verification. The Georgia Trauma Commission reimbursed trauma centers for costs associated with consultative site visits to mitigate financial barriers to participation. The consultative arm of our study cost the state roughly $287,000. The range of consultative visit costs was $18,000 to $23,000 per center. Fees associated with ACS verification are included in the annual readiness costs funded by the Georgia Trauma Commission.

We measured the effect of this intervention in three ways: First, trauma center progress from initial ACS consultation through successful ACS verification was tracked. Second, observed-to-expected (O/E) ratios, reflecting risk adjusted outcomes, were trended for TQIP major hospital events, including and excluding mortality, in each of the eight patient-specific cohorts: *All Patients*, *Blunt Multisystem*, *Penetrating*, *Shock*, *Severe Traumatic Brain Injury*, *Elderly*, *Elderly Blunt Multisystem*, and *Isolated Hip Fracture*. Of note, the state regulatory entity did not require the inclusion of isolated hip fracture cases into the state trauma registry until 2017. Therefore, the inclusion of data for the *Isolated Hip Fracture* cohort was variable among GQIP participants. Third, the range of O/E ratios across these cohorts was trended to measure performance variability across the system. This measure was chosen due to the heterogeneity of patient populations across participating centers. Large variability is a sign of unreliable or inconsistent patient care, and reducing this variability is an essential goal of quality improvement. In data science, reduction in variation, as seen by a reduction in standard deviation, is an early observation in process improvement even before improvement is seen in other common measures such as means or medians. This is likely from improvement in variability in processes and increased reliability in the system to achieve the goals of improvement in patient outcomes.[10,11]

RESULTS

In 2015, only one of fifteen (7%) Georgia level I and II trauma centers was ACS verified, and four had undergone consultative visits. By the end of 2019, all level I and II trauma centers had undergone ACS consultative visits except for one level II center, which opted to go straight to ACS verification without consultation. During the study period, two level II trauma centers voluntarily transitioned to level III designation post-ACS consullation. One Level I center voluntarily withdrew from the trauma system, and the hospital subsequently closed. Of the original fifteen centers, eleven (73%) successfully achieved level I or II ACS verification by 2023.

In fall 2015, the collaborative O/E ratio for the all-patient cohort, including mortality, was 1.60, with patient-specific cohort O/E ratios ranging from 0.97 to 1.82 (range, 0.85), Figures 1 and 2. By fall 2019, when all ACS consultative visits were completed, the O/E ratio had decreased to 1.13, with variation narrowing to 0.95 to 1.29 (range 0.34), Figure 2. In 2023, when 11 of 12 centers had achieved ACS verification, the all-patients O/E ratio was 1.17 with a variation of 0.96 to 1.48 (range, 0.52), Figures 2 and 3.

The all-patients O/E ratio has been less than 1.3 since 2018, demonstrating the intervention's sustainability. Likewise, the variation range has shown improvement and sustainability as it was consistently greater than 0.70 in the early study period. However, it has been below 0.55 in the last **5** years of the study. Six of seven patient-specific cohorts (all but *Isolated Hip Fracture*) had O/E ratios greater than 1.40 in 2015. Performance improved in all six of these cohorts over the course of the intervention.

To further measure the effect, we evaluated risk adjusted major complications, excluding mortality. In fall 2015, the collaborative O/E ratio for the all-patient cohort, excluding mortality, was 1.67, with patient-specific cohort O/E ratios ranging from 0.99 to 1.77 (range, 0.78), Figures 4 and 5. By fall 2019, when all ACS consultative visits were completed, the O/E ratio had decreased to 1.05, with variation narrowing to 1.0 to 1.25 (range, 0.25), Figure 5. In 2023, when 11 of 12 centers achieved

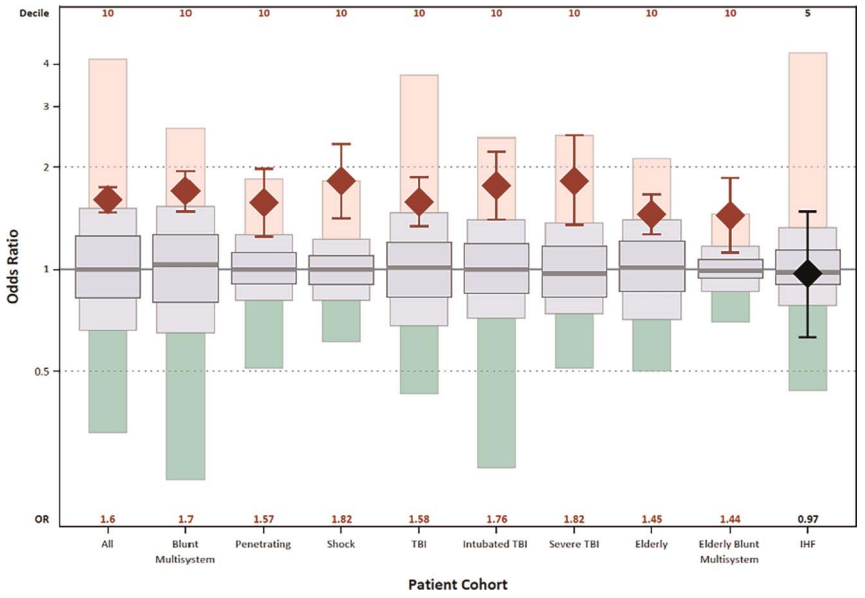

Figure 1. Fall 2015 TQIP collaborative benchmark report; risk adjusted major complications including death.

ACS verification, the all-patients O/E ratio was 1.06 with a variation of 0.99 to 1.25 (range, 0.26), Figures 5 and 6.

Similar to the model including mortality, the variation range has shown improvement and sustainability across the study period. Notably, performance across all cohorts (excluding *Isolated Hip Fracture*) demonstrated improvement (Figs. 5 and 6). To account for the impact of the three centers withdrawing from the collaborative, the analysis was repeated, excluding the three centers that withdrew, and the O/E improvement was still present among the remaining centers for major hospital events, including and excluding mortality.

DISCUSSION

Implementing a requirement for ACS consultation and subsequent ACS verification was associated with improved outcomes for the Georgia statewide collaborative. Eleven of the original 15 level I and II trauma centers achieved ACS verification within the defined timeframe. Over this interval, statewide performance improved across multiple patient cohorts, and the performance variability between patient cohorts decreased.

Much of the improvement in both the all-patients O/E ratio and the cross-cohort variation was seen in the first phase of implementation, suggesting that the consultative visit was impactful. The observation of improvements beyond the measured, intended target of an intervention has been implicated in improved outcomes with quality improvement and resident education initiatives,[12,13] in cancer screening programs,[14] and in the care of nontraumatic surgical patients at trauma centers.[15–17] While only half of the participating centers had achieved verification by 2019, it is plausible that the other centers improved their processes by networking and sharing information from the consultative visits at the collaborative meeting. This improvement may have been facilitated by requiring the trauma program's leadership (trauma program manager, trauma medical director, and trauma administrator) to participate in collaborative initiatives and meetings where overall system performance was reviewed and best practices were disseminated. This exemplifies the synergy between ACS verification and collaborative participation, as the sum of these two processes is more powerful than either process alone.

GQIP meets four times annually, twice in person and twice virtually. GQIP staff includes a medical director, nurse

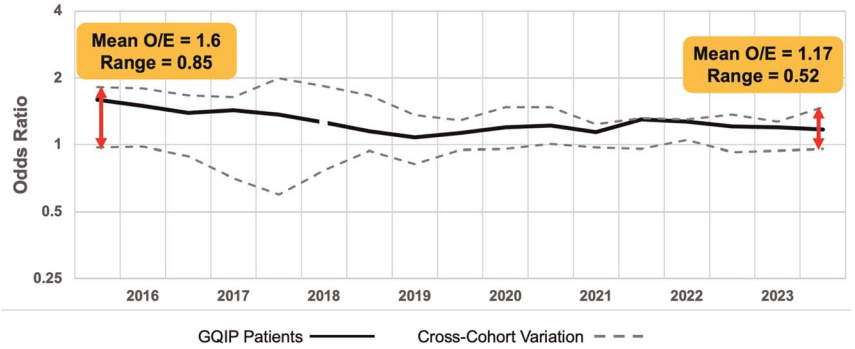

Figure 2. Risk adjusted major complications, including mortality, for all TQIP collaborative patients (solid line). Cross-cohort variation marked with dashed lines. Break in trendline reflects data missing for Spring 2018.

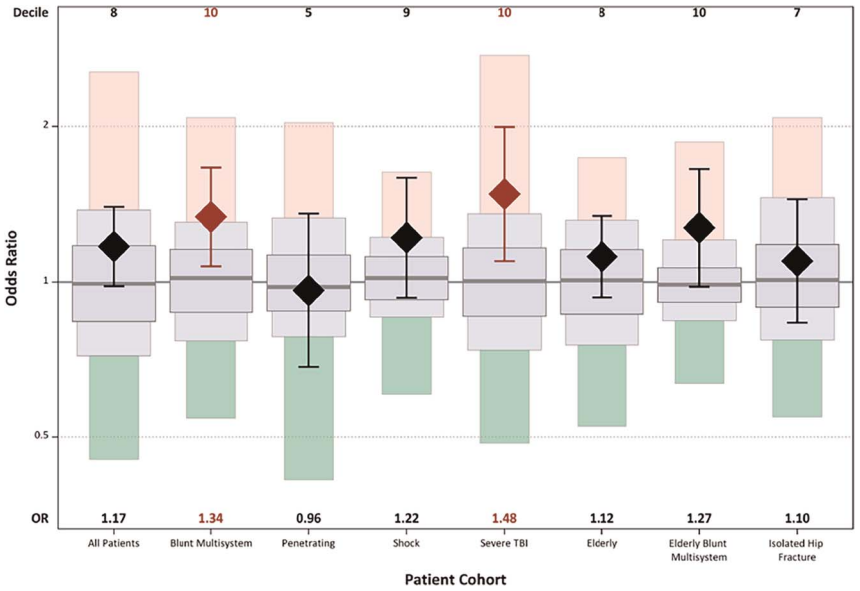

Figure 3. Fall 2023 TQIP collaborative benchmark report; risk-adjusted major hospital events including death.

director, and research scholar to provide support, review data, and drive quality improvement projects. Stakeholder workgroups focus on identified problems or projects and develop shared clinical practice guidelines. The Georgia Trauma Commission provides collaborative programmatic funding support. The value of collaborative participation is achieved through meetings, education, case studies, workgroups, camaraderie, and trust, which develops over time. Furthermore, global opportunities for improvement can be identified by looking at patient outcomes at the collaborative level. Through GQIP meetings and networking, low-performing centers can leverage information and processes from their higher-performing counterparts. In addition to improvements at the center and collaborative level, data can inform advocacy strategies for trauma system development and funding for an entire state.

Notably, the all-patient O/E ratio and the variation between patient-specific cohorts both remained decreased from baseline consistently for 10 semiannual cycles, from spring 2019 through fall 2023. In quality improvement, sustainability is challenging, even more so through the COVID-19 pandemic, during which delays in consultative and verification visits occurred. During this challenging period, the demonstrable sustained improvement highlights that ACS verification provides a stable framework that sets clear expectations for unforeseen crises, leadership succession, and other programmatic changes.

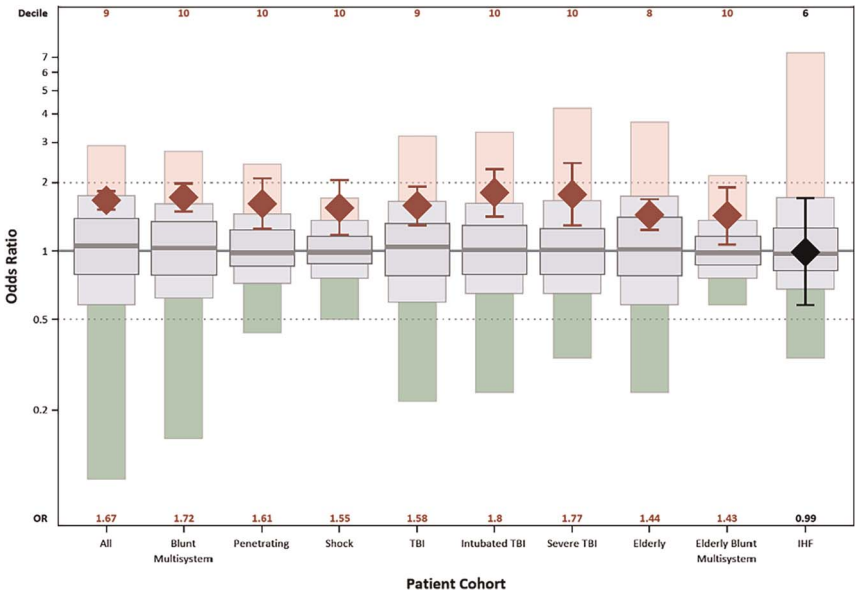

Figure 4. Fall 2015 TQIP collaborative benchmark report; risk-adjusted major complications by cohort.

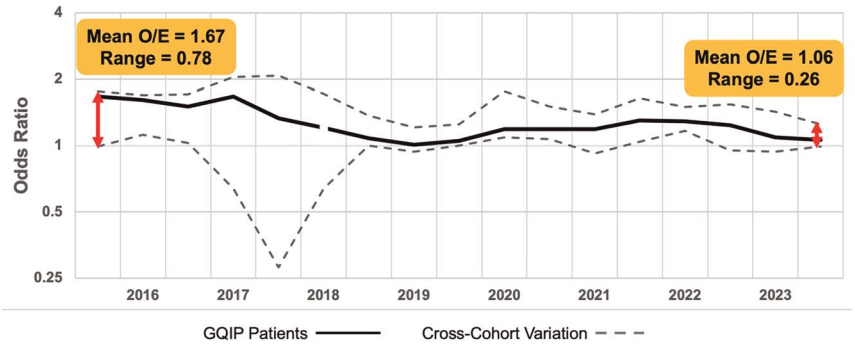

Figure 5. Risk adjusted major complications, excluding mortality, for all TQIP collaborative patients (solid line). Cross-cohort variation marked with dashed lines. Break in trendline reflects data missing for Spring 2018.

ACS verification is the evidenced-based "gold standard" for evaluating the quality of trauma care programs. We propose that ACS verification positively impacts outcomes because the ACS utilizes formally trained, experienced surveyors from across the country who can remain unbiased in holding the centers accountable to verification standards. Site visit findings are adjudicated through a peer review committee process (Verification Review Committee).[18] Currently, 47 states use the verification process in some form, many as a proxy for state designation (Assistant Director of Trauma Quality Programs at The American College of Surgeons, email communication, 12/29/2023). Like other states, Georgia was challenged to provide an equivalent process of rigor with its limited fiscal resources, infrastructure, and clinical expertise.

Implementing a statewide ACS verification requirement was a significant milestone in Georgia's our state trauma system maturation. The ACS verification requirement was a grassroots effort that exemplified how bottom-up, stakeholder-generated empowerment can influence change at the state level. A formal motion to recommend the ACS verification requirement was made to the Georgia Trauma Commission from a stakeholder committee comprised of trauma programmatic staff. Despite overwhelming support from the stakeholders, an appropriate lead time and support for the ACS Consultative process were vital to ensuring all centers had the best chance of achieving verification. One of the outcomes of the ACS verification requirement was the "rightsizing" of the trauma center level. Through the ACS consultative process, two level II centers voluntarily transitioned to level III state designation, which more appropriately matched their personnel and resource capabilities. One of these centers has since become successfully verified as an ACS level III trauma center. This rightsizing ensures a center is designated at a level that matches resources to patient needs and demonstrates that taxpayer funding is responsibly allocated in support of trauma center readiness.

There are a variety of ways to measure the performance of a statewide collaborative and multiple variables that can affect it, so this report is inherently limited in its inability to capture these concepts globally. We emphasize that variation is as important to focus on as overall performance. If some centers perform well while others consistently underperform, there is limited benefit to the collaborative. Furthermore, if some patient populations

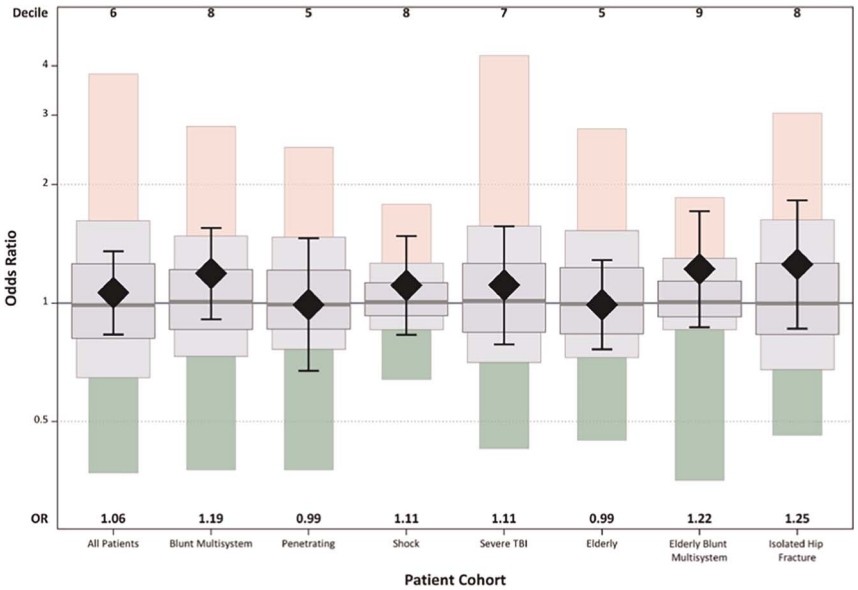

Figure 6. Fall 2023 TQIP collaborative benchmark report; risk-adjusted major hospital events by cohort.

benefit while others receive worse care, there could be concern that efforts perpetuate disparities. The collaborative aims to have all centers learn from each other and find ways to generalize and adopt best practices of high performers. By decreasing variability and standardizing care across the collaborative, we can be confident in the benchmark reports as a true performance marker and focus on more granular opportunities for improvement.

GQIP aims to assist trauma centers in their pursuit of optimizing outcomes for trauma patients. Our focus now includes strengthening our collaboration with and supporting level III and IV trauma centers. The next steps include developing and standardizing a customized risk-adjusted benchmarking platform with more contemporary feedback for all levels of trauma centers, allowing the opportunity to respond more rapidly to variation. Due to the improvements demonstrated on the risk-adjusted benchmark reports since the ACS verification requirement for the level I and II trauma centers, ACS verification is now required for level III trauma centers. Evidence suggests there is potentially even more to gain in process improvement compared with their level I and II counterparts.[19] External consultative visits are also being provided for the level IV trauma centers.

Our study has several nuances and limitations that must be considered. The TQIP Spring 2018 collaborative report cycle was skipped, and data were incorporated into the Fall 2018 report; however, this did not affect the overall outcome as the dataset was included in the subsequent report. The COVID-19 pandemic occurred 3 years after the promulgation of the ACS verification requirement. The pandemic caused delays in some ACS site visits, and the site visit format shifted to virtual during that time, but the timeline for centers to achieve ACS verification was not affected and did not require adjustment. Much of the literature has described the strain on hospitals during the pandemic, which may have limited the ability to achieve an even greater reduction in variability. This was an analysis of collaborative performance as opposed to a detailed study of individual center O/E performance; however, in general, individual center performance improved after consult or verification visits over the study period.

About one-third of the centers had verification visits in 2023, the last year of the study period, which may have underestimated the overall impact because our analysis ended with the fall 2023 TQIP Collaborative report. TQIP reports have as much as an 18-month delay from when care was provided to when the reports are available to participating centers. Therefore, we may see improvement over subsequent reports. We have observations from eight TQIP reports after our last consult visit and one TQIP report after our last verification visit. The dates of these visits are different for centers across the collaborative, so we are not able to reliably conclude the time to improvement for the collaborative based on the timing of the consult or verification visits, only that improvement occurred across the collaborative in an aggregate manner over the observed period in which this program was being implemented. Our state is fortunate to have a dedicated funding mechanism. A requirement for ACS consultative and verification visits may not have been possible without the funding that was made available for the visits, as well as tying ongoing trauma readiness funding to achieving ACS verification.

CONCLUSION

Requiring ACS verification was associated with improved outcomes and decreased variation across centers participating in a statewide trauma collaborative. There are clear and well-established benefits to participating in a quality collaborative and undertaking the process of ACS verification. Collaborative performance in the setting of ACS verification supports the notion that those benefits are complementary and additive. We recommend that any state or region consider ACS verification for trauma center designation based on the improvement in TQIP collaborative performance and, wherever feasible, for states to support and incentivize their participating trauma centers in taking on this process.

AUTHORSHIP

All authors were actively involved in the drafting and critical revision of the article, and each author provided final approval of the version to be published. E.V.A., E.M., D.W.A. participated in the conception and study design. E.V.A., E.M. participated in the literature review. E.V.A., E.M., J.S., G.S. participated in the data acquisition. E.V.A., E.M., R.S.M., JS, G.S., L.G., J.R.D., D.W.A. participated in the data analysis and interpretation. E.M., E.V.A., R.M. participated in the drafting of the article. E.M., E.V.A., R.M., J.S., G.S., L.G., S.R.T., R.J.D., D.W.A. participated in the critical revision.

DISCLOSURE

Conflict of interest statement and disclosure statement: Author Disclosure forms have been supplied and are provided as Supplemental Digital Content (http://links.lww.com/TA/E192).

Funding: No funding was provided for this study.

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