Potential impact of Affordable Care Act–related insurance expansion on trauma care reimbursement

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BACKGROUND: Nearly one quarter of trauma patients are uninsured and hospitals recoup less than 20% of inpatient costs for their care. This study examines changes to hospital reimbursement for inpatient trauma care if the full coverage expansion provisions of the Affordable Care Act (ACA) were in effect.

METHODS: We abstracted nonelderly adults (ages 18–64 years) admitted for trauma from the Nationwide Inpatient Sample during 2010—the last year before most major ACA coverage expansion policies. We calculated national and facility-level reimbursements and trauma-related contribution margins using Nationwide Inpatient Sample–supplied cost-to-charge ratios and published reimbursement rates for each payer type. Using US census data, we developed a probabilistic microsimulation model to determine the proportion of pre-ACA uninsured trauma patients that would be expected to gain private insurance, Medicaid, or remain uninsured after full implementation of the ACA. We then estimated the impact of these coverage changes on national and facility-level trauma reimbursement for this population.

RESULTS: There were 145,849 patients (representing 737,852 patients nationwide) included. National inpatient trauma costs for patients aged 18 years to 64 years totaled US $14.8 billion (95% confidence interval [CI], 12.5,17.1). Preexpansion reimbursements totaled US $13.7 billion (95% CI, 10.8–14.7), yielding a national margin of −7.9% (95% CI, −10.6 to −5.1). Postexpansion projected reimbursements totaled US $15.0 billion (95% CI, 12.7–17.3), increasing the margin by 9.3 absolute percentage points to +1.4% (95% CI, −0.3 to +3.2). Of the 263 eligible facilities, 90 (34.2%) had a positive trauma-related contribution margin in 2010, which increased to 171 (65.0%) using postexpansion projections. Those facilities with the highest proportion of uninsured and racial/ethnic minorities experienced the greatest gains.

CONCLUSION: Health insurance coverage expansion for uninsured trauma patients has the potential to increase national reimbursement for inpatient trauma care by over one billion dollars and nearly double the proportion of hospitals with a positive margin for trauma care. These data suggest that insurance coverage expansion has the potential to improve trauma centers' financial viability and their ability to provide care for their communities. (*J Trauma Acute Care Surg.* 2017;82: 887–895. Copyright © 2017 American Association for the Surgery of Trauma. All rights reserved.)

LEVEL OF EVIDENCE: Economic analysis, level II.

KEY WORDS: Affordable Care Act; health insurance; health policy; reimbursement; trauma centers.

Trauma is the second most costly medical condition in the United States in terms of health care spending—accounting for over US $92 billion in annual expenditures.[1] Given the nature of traumatic injury, trauma centers often care for some of the most economically disadvantaged and otherwise underserved populations—especially those without insurance.[2,3] Nationally, almost one of every five trauma patients are uninsured.[4–7] Especially for those trauma centers serving as a community safety net, the high proportion of uncompensated care provided to the uninsured and underinsured at many US trauma centers often leads to negative financial margins, where costs exceed reimbursement. Whereas hospitals may be reimbursed more than 130% of the cost of inpatient trauma care by many private insurers, they recoup less than 20% of these costs when patients are uninsured.[8,9] Uninsured patients are more likely to be transferred to a tertiary referral center than insured patients, regardless of clinical severity.[7,10,11] This practice only increases the burden of margin-negative care on the trauma referral centers caring for the most vulnerable populations. Ultimately, these facilities are at risk of financial insolvency and closure.[12,13]

The recent passage of the Patient Protection and Affordable Care Act (ACA) has resulted in significant changes to the number of Americans with insurance coverage. As more than 20% of nonelderly adult trauma patients were uninsured before

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the ACA,[3–7,14] population-level changes in insurance coverage will have a significant impact on payer mix and thus financial margins for trauma care. Despite these ongoing changes, there are no existing estimates of the ACA's potential impact on national-level changes in payer mix and subsequent reimbursement for trauma care. Understanding the potential impact of the ACA on trauma center financial performance is important for trauma surgeons, administrators, hospitals, and policy makers who must navigate the emerging policies and debates regarding continued health policy reform.

In this study, we explored two questions regarding the potential effects of the ACA on trauma care in the United States. First, we sought to estimate the impact of ACA-related insurance expansion polices on insurance status of historically uninsured trauma patients. Second, we sought to quantify the impact of these coverage expansion policies on reimbursement and profit margins for trauma care at both the national and facility levels.

PATIENTS AND METHODS

Study Design and Patient Population

We performed a population-level analysis using the Nationwide Inpatient Sample (NIS) to create nationally-representative estimates of the impact of the ACA on trauma care. The NIS includes all annual discharges from 20% of participating acute care hospitals and is purposefully designed to provide national-level estimates.[14] Our study cohort included all injured nonelderly adults (ages 18–64 years) from the 2010 NIS. Injury was defined by the International Classification of Diseases, Ninth Revision, Clinical Modification diagnoses codes 800-959. Insurance status is provided by the NIS and was categorized into the following five groups: Private, Medicaid, Medicare, Uninsured (self-pay), or Other (Worker's Compensation, US Military-sponsored coverage, and other government programs). For facility-level analyses, we included all facilities with at least 100 trauma admissions in 2010. Facility-level traits of interest included location, teaching status, bed-size, payer-mix, and the racial and ethnic composition of patients seen by each hospital.

To estimate the future impact of policies that are still actively ongoing, we relied on data from the 2010 NIS—the last year before most of the ACA-related insurance coverage expansion policies—and compared the observed 2010 values (pre-ACA) against modeled estimates (post-ACA) that are derived from the best available published data from the literature and governmental survey data from the US Census Bureau.[8,9,15–20] To build our model for post-ACA estimations, we determined the following: (i) the probability that an uninsured patient would be eligible for Medicaid or private insurance coverage, (ii) the likelihood that a newly eligible patient would actually enroll in the policy, and (iii) the ratio of inpatient costs to hospital reimbursement for trauma care for different payers.

Probability of Insurance Coverage Eligibility and Enrollment

The coverage-expansion policies of the ACA most relevant to this analysis are (1) expansion of state-level Medicaid eligibility, (2) governmental premium tax credits (PTCs) for individuals to buy private insurance plans through a Health Insurance Marketplace (often referred to as "exchanges"), and (3) the individual and employer mandates. An individual's eligibility for Medicaid or PTCs is based on income relative to the federal poverty line (FPL) and the state in which they live. At the time of this analysis, only 32 states had elected to expand Medicaid eligibility, thus eligibility thresholds differ by state. In states that expanded Medicaid, US citizen below 138% FPL are eligible for Medicaid and those between 138% and 400% FPL are eligible for PTCs. In nonexpanding states, US citizens between 100% and 400% FPL are newly eligible for PTCs, and a small number of individuals below 44% FPL are likely eligible for Medicaid but unenrolled.[15]

To determine the probability of gaining coverage for each of the uninsured patients in our data set, we relied on US census data to model estimated incomes. The NIS assigns patients to a quartile classification of community income level (1, lowest; 4, highest) based on the median income level of the patient's zip code. By combining NIS-supplied income thresholds for these quartiles with data from the 2010 US census on national distribution of household incomes, we calculated a mean household income value for each community income quartile. We then used techniques described by Salem and Mount,[21] and more recently by Shrime et al.,[22] to generate a gamma probability distribution of all incomes in that quartile (see Appendix). By doing this, we were able to assign each patient an estimated income drawn from their quartile-specific income distribution, converted it to a percentage of the FPL, and determined whether or not they would be eligible for Medicaid, private coverage, or neither. Performing this calculation on every uninsured patient in the data set enumerated the proportion of previously uninsured patients that would be eligible to gain Medicaid, the proportion that would be eligible for private insurance, and the proportion that would not be eligible for either. We assumed that 12% of the uninsured population were undocumented immigrants and thus are never eligible for coverage gains.[15] We used a microsimulation model to repeat this process 10,000 times and obtained an overall population-weighted estimate of insurance coverage eligibility for the uninsured nonelderly adult trauma patients. See the Appendix for additional model assumptions.

We also addressed the possibility that a patient who might be newly eligible for Medicaid or PTCs or is subject to the mandate may still not elect to enroll in coverage. Analysis of a recent summary of projected enrollment rates under the ACA reveals that the midpoint of a variety of estimates is approximately 75%.[23] We thus applied this 75% enrollment estimate to the aforementioned eligibility calculations to generate our best estimate for change in payer mix after full ACA implementation.

Determination of Cost, Revenue, and Contribution Margin

We converted the inpatient hospital charges provided in NIS into estimated costs using Healthcare Cost and Utilization Project provided cost-to-charge ratios; these estimates from year 2010 were normalized to 2015 USD using annual hospital consumer-price indices.[24] To calculate estimated reimbursements, we relied on previously published analyses of trauma center reimbursement to calculate a ratio of reimbursement to hospital costs based on insurance status (Private, Medicaid, Medicare, Uninsured, and Other) (Fig. 1).[8] For example, our primary estimates suggest that average reimbursement for Medicaid patients covers 60.2% of inpatient costs. As such, a patient

insured by Medicaid who accrued US $10,000 in inpatient costs would account for US $6,020 of hospital revenue. For the preexpansion calculations, patient-level costs were multiplied by the revenue-to-cost estimates associated with their insurer. For post-ACA calculations, an uninsured patient's costs were calculated by the following equation:

$$\text{Post-ACA Revenue} = \text{cost} \times \left[p_{(\text{PRIVATE})} \times r_{(\text{PRIVATE})} + p_{(\text{MEDICAID})} \times r_{(\text{MEDICAID})} + p_{(\text{UNINSURED})} \times r_{(\text{UNINSURED})}\right]$$

In this equation, $p_{(\text{PRIVATE})}$, $p_{(\text{MEDICAID})}$, and $p_{(\text{UNINSURED})}$ represent the probability that a patient without insurance would be covered by each possible payer type after the ACA, as calculated above. The $r_{(\text{PRIVATE})}$, $r_{(\text{MEDICAID})}$, and $r_{(\text{UNINSURED})}$ terms represent the insurer-specific revenue-to-cost estimates shown in Figure 1. For example, if a patient had a 33% probability of gaining private coverage, a 33% probability of gaining Medicaid, and a 33% probability of remaining uninsured, then their estimated reimbursement would be the cost of their care times 1:3 the private reimbursement ratio plus the cost of their care times 1:3 the Medicaid reimbursement ratio plus the cost of their care times 1:3 the uninsured reimbursement ratio.

Population-level costs and reimbursements were calculated as the sum of all patient costs and reimbursements, and NIS-supplied discharge weights were applied to ensure national-representativeness. National- and facility-level trauma-related contribution margins were calculated according to the equation: margin = (revenue − cost)/revenue.

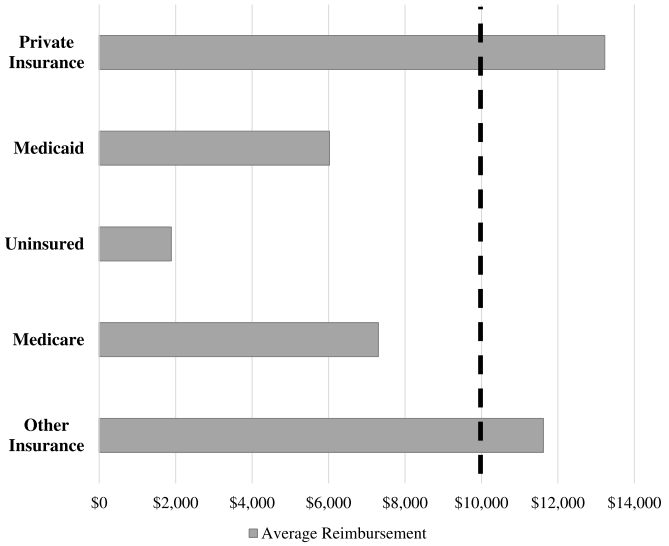

Figure 1. Average estimated payer-specific reimbursement for US $10,000 of in-hospital costs among US Trauma Patients. The average estimated payer-specific reimbursement (*grey bars*) is presented relative to a hypothetical inpatient cost of US $10,000 (*black dashed line*). The resultant payer-specific average reimbursement-to-cost ratios used in our calculations are as follows: private insurance 1.322, Medicaid 0.602, Uninsured 0.189, Medicare 0.730, and other insurance 1.622. See Appendix for sensitivity analyses with alternative reimbursement-to-cost ratios.

Sensitivity Analyses

To determine the impact that our estimated enrollment rate had on our outcomes, we performed a series of sensitivity analyses. First, instead of using the 75% estimate as noted in our primary analysis, we used an upper bound enrollment estimate of 95% as proposed by the Congressional Budget Office[18] and then a revised lower-bound estimate of 62% enrollment proposed by Sommers et al.[19] Additionally, our primary model relies on the derivation of payer-specific reimbursement-to-cost ratios for US trauma patients, as described by Shafi et al.[8] To ensure that our findings were robust and not driven solely by the source of reimbursement-to-cost ratios, we used two other recently published approaches.[9,20] See the Appendix for full specification of the primary model and all four sensitivity analyses.

RESULTS

Our final analytic data set included 145,849 injured nonelderly adults (ages 18–64 years), weighted to represent 737,852 patients nationally in 2010 (see Supplemental Figure 1, Supplemental Digital Content 1, http://links.lww.com/TA/A896). Before the ACA, 43.6% of eligible trauma patients had private insurance, 18.9% were uninsured, 15.2% had Medicaid, 13.0% had other insurance, and 9.4% had Medicare (Fig. 3).

Our post-ACA model predicted that 57.9% of previously uninsured 18- to 64-year-old trauma patients would be eligible to gain private coverage, 19.7% would be eligible for Medicaid, and 22.4% would not be eligible for either. Assuming 75% enrollment, this corresponds with 43.4% of the previously uninsured gaining private coverage, 14.6% gaining Medicaid, and 41.8% remaining uninsured (Fig. 2). Taken together, the post-ACA national payer-mix estimated from our simulation model suggests that 52.0% patients would have private insurance, 17.9% Medicaid, and only 7.8% would remain uninsured (Fig. 3). The results of our model closely mirror other coverage eligibility estimates based on the US Bureau of Labor and Statistics Current Population Survey (see Supplemental Figure 2, Supplemental Digital Content 1, http://links.lww.com/TA/A896).

In 2010, national inpatient costs for trauma care totaled US $14.8 billion (95% posterior credibility interval (PCI): 12.5 billion, 17.1 billion), while estimated national reimbursements totaled US $13.7 billion (95% PCI, 11.6 billion to 15.9 billion), resulting in a negative national trauma-related contribution margin of −7.86% (95% PCI, −10.63% to −5.10%) (Table 1). Post-ACA estimates based on the same level of costs suggest reimbursement would increase to US $15.0 billion (95% PCI, 12.7 billion to 17.3 billion). This translates to a US $1.29 billion (95% PCI, 1.02 billion to 1.57 billion) increase in national trauma-related reimbursement for equivalent costs. These gains correspond to a +9.28 (95% PCI, +6.01% to +12.54%) percentage-point increase in trauma-related contribution margin, resulting in a post-ACA national margin of +1.42% (95% PCI, −0.32% to +3.15%).

Of the 263 facilities with at least 100 trauma admissions in 2010, the mean pre-ACA trauma-related contribution margin in 2010 was −6.4% (95% PCI, −8.0% to −4.7%). Post-ACA, the mean is predicted to increase to +2.6% (95% PCI, +1.6% to +3.6%). Comparing the pre- and post-ACA distribution of facility-level margins for trauma care, the greatest gains are predicted to be seen among the facilities with the lowest margins

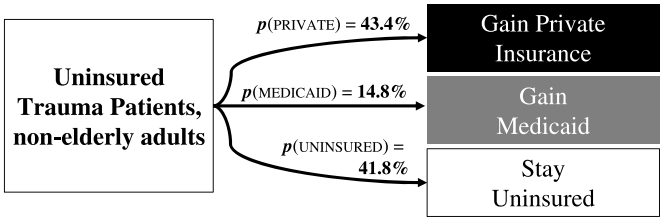

Figure 2. Insurance coverage gains for uninsured trauma patients after ACA implementation. Estimated gains in insurance coverage among the already uninsured nonelderly trauma patients after ACA-related insurance coverage expansion. Note: The model above assumes 75% enrollment among patients eligible for Medicaid, premium tax credits, or required to obtain coverage under the ACA. Also, an estimated 12% of all uninsured individuals are undocumented immigrants and thus are not eligible for coverage gains outlined above.

pre-ACA (Fig. 4). In 2010, only 34% (n = 90) of all 263 facilities had a positive margin, post-ACA this number is estimated to nearly double to 65% (n = 171). Details of the variation in pre- and post-ACA margins by facility subtype are shown in Table 2. Notably, the most negative margins pre-ACA and the greatest post-policy gains expected to be seen among facilities that care for the greatest proportion of uninsured patients and those that care for greatest proportion of nonwhite patients.

Results of our four sensitivity analyses, which used alternative coverage uptake estimates and alternative cost-reimbursement ratios, showed qualitatively similar results. Estimated gains in national reimbursement ranged from a low-end estimate of a +US $1.06 billion (95% PCI, 0.83 billion to 1.28 billion) to a high-end estimate of +US $1.63 billion (95% PCI, 1.29 billion to 1.99 billion). Corresponding changes in national margin ranged from a low estimate of +4.7 (95% PCI, +2.5% to +6.9%) percentage points to a high estimate of +12.05 (95% PCI, +8.2% to +15.9%) percentage points. Complete results of our sensitivity analyses are available in Supplemental Tables1 and 2 (Supplemental Digital Content 1, http://links.lww.com/TA/A896).

DISCUSSION

Our analysis to assess the impact of the ongoing coverage expansion policies on insurance coverage rates and trauma care reimbursement in the United States suggests that approximately 40% of previously uninsured nonelderly adult trauma patients are expected to gain private insurance, and another 14% will likely enroll in Medicaid. Due to these changes in payer-mix, we estimate that trauma centers could receive over one billion dollars in increased revenue, corresponding to a more than 9% absolute increase in profit margin nationally. At the facility level, we estimate that the proportion of hospitals delivering margin-positive trauma care—a critical determinant of financial sustainability—will nearly double from less than 35% to over 65%.

Our findings suggest that a large proportion of nonelderly adults without insurance pre-ACA may gain private coverage. These findings are highly consistent with the best available eligibility estimates derived from analysis of the Current Population Survey.[15] Enrollment in Medicaid and private insurance plans with the assistance of premium tax credits will be vital to the success of the ACA's coverage expansion efforts. The national proportion of uninsured nonelderly trauma patients is likely to decrease from a pre-ACA level of almost 20% to less than 10% (or even as low as 5%), depending on enrollment rates. Higher uptake of both Medicaid and private insurance plans will be beneficial to trauma centers currently caring for a large proportion of uninsured patients.

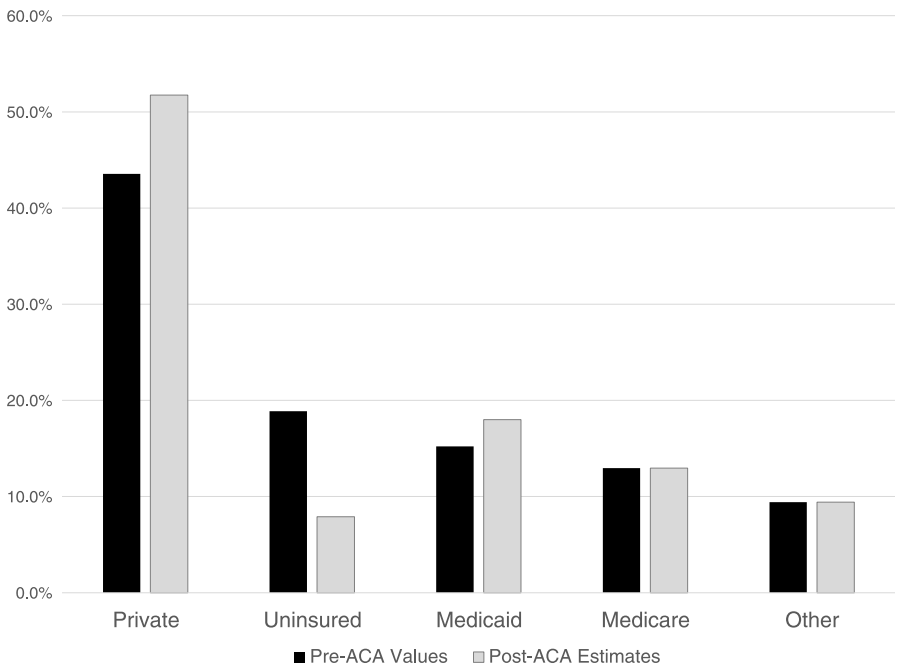

Figure 3. Pre- and post-ACA National Payer Mix for nonelderly adult trauma patients pre-ACA payer-mix is represented by the black bars. Results of insurance expansion model based on simulated incomes are shown in gray.

TABLE 1. National Costs, Reimbursement, and Profit Margin for Nonelderly Adult Trauma Care

	Nationally Weighted Total, US $	95% CI		Contribution Margin, %	95% PCI	
Total costs	14,805,677,817.78	US $12,477,937,185.54	US $17,133,418,450.01	—	—	—
Pre-ACA revenue	13,726,622,266.12	US $11,602,366,257.79	US $15,850,878,274.45	−7.86%	−10.63%	−5.10%
Post-ACA revenue	15,018,470,665.53	US $12,704,289,901.44	US $17,332,651,429.62	1.42%	−0.32%	3.15%
Pre-/post-change	1,291,848,399.44	US $1,015,792,385.21	US $1,567,904,413.67	9.28%	6.01%	12.54%

Authors' interpretation of data from the NIS, 2010.

From an individual hospital or healthcare system's vantage point, caring for an uninsured trauma patient with US $10,000 in hypothetical costs could result in an average loss of –US $8,114; caring for a patient with private insurance with identical costs could result in an average profit of+ US $3,225 (Fig. 3). It is therefore unsurprising that the largest gains in facility-level margins were found among those facilities that care for the highest proportion of pre–ACA-uninsured patients (Table 2 and Fig. 4). Conversely, those facilities who cared for the lowest proportion of pre-ACA uninsured patients will experience the smallest changes in payer mix and reimbursement due to insurance coverage expansion. Reductions in the amount of negative-margin care provided by vulnerable facilities is vital to their financial health as trauma center closures are almost 40% more likely if the center has a negative profit margin.[12] Medicaid eligibility and reimbursement have been shown to be among the most significant determinants of financial solvency or closure for trauma centers and safety-net hospitals.[12,25] Additionally, prior studies have shown a strong link between higher proportions of uninsured patients and higher mortality rates.[4,26] Because insurance coverage expansion has the potential to enhance the financial viability of critically important trauma centers, the subsequent impact on clinical outcomes should be rigorously assessed.

It is important to note, however, that these estimates focus only on the effects of the ACA's coverage expansion policies. Significant concerns have been raised among trauma providers and others delivering safety-net care that planned ACA-related reductions to Medicaid's disproportionate share hospital (DSH) program could markedly compromise the financial viability of trauma centers and safety-net providers.[9,27–29] Predicting the effects of these planned DSH payment reductions is challenging because specific regulations regarding the amount each facility received from DSH payments are regulated by states and thus greatly variable. DSH is also a small fraction of total Medicaid spending (only 4% in 2012).[25] Additionally, a recent analysis found that DSH funding level was not a significant predictor of financial performance among safety-net hospitals before the ACA.[25] Our current analysis cannot predict the magnitude of DSH funding involved in trauma care; however, it does provide estimates regarding the degree to which key ACA coverage expansion efforts alone will change payer mix and

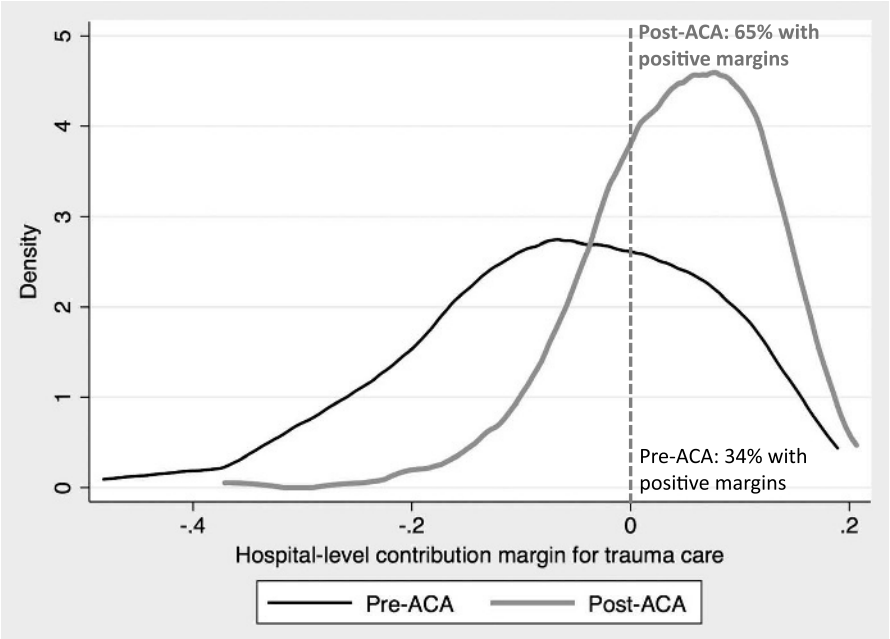

Figure 4. Pre- and post-ACA distribution of hospital-level contribution margins for trauma care (n = 263 facilities). Distribution of hospital-level contribution margins for trauma care before the ACA (*black line*) and after the ACA (*gray line*). Vertical dashed line represents margin of zero. Before the ACA 34% of facilities had positive margins for trauma care, after the ACA an estimated 71% of facilities would have positive margins for trauma care.

TABLE 2. Changes in Facility-Level Trauma-Related Contribution Margin for Inpatient Costs Due to ACA-Related Coverage Expansion

Facility Traits	Facilities, n (%)	Pre-ACA Contribution Margin, % (95% PCI)	Post-ACA Contribution Margin, % (95% PCI)	Pre-/Post-ACA Change in Margin, % (95% PCI)	*p* Value for Between Group Difference
Total population					
All included facilities*	263	−6.4% (−8.0%, −4.7%)	2.6% (1.6%, 3.6%)	9.0% (8.1%, 9.9%)	n/a
Location and teaching status					
Urban, teaching	118 (45%)	−7.4% (−9.9%, −4.8%)	1.8% (0.1%, 3.4%)	9.3% (7.8%, 10.8%)	Reference
Urban, nonteaching	114 (43%)	−4.8% (−7.2%, −2.4%)	3.6% (2.2%, 5.0%)	8.4% (7.1%, 9.7%)	0.797
Rural	26 (10%)	−8.9% (−13.8%, −4.0%)	2.0% (−1.1%, 5.0%)	10.9% (8.3%, 13.4%)	0.862
Hospital bed size					
Large	181 (69%)	−6.1% (−8.0%, −4.2%)	2.7% (1.4%, 3.9%)	8.9% (7.9%, 9.9%)	Reference
Medium	60 (23%)	−8.2% (−12.0%, −4.4%)	1.9% (−0.3%, 4.0%)	10.1% (7.8%, 12.3%)	0.13
Small	17 (6%)	−2.9% (−9.3%, 3.4%)	4.4% (−0.3%, 9.1%)	7.3% (4.4%, 10.3%)	0.336
Proportion of patients with nonwhite race/ethnicity					
Less than 25%	117 (45%)	−0.8% (−2.7%, 1.2%)	5.7% (4.4%, 7.1%)	6.5% (5.6%, 7.4%)	Reference
25% to 50%	71 (27%)	−9.3% (−12.6%, −6.0%)	2.2% (0.4%, 3.9%)	11.5% (9.4%, 13.5%)	<0.001
Greater than 50%	73 (28%)	−12.1% (−15.1%, −9.1%)	−1.7% (−3.8%, 0.3%)	10.6% (8.7%, 12.5%)	<0.001
Proportion of uninsured patients (by quartile)					
Lowest quartile (<12% uninsured)	66 (25%)	4.2% (1.8%, 6.5%)	6.1% (3.9%, 8.3%)	1.9% (1.6%, 2.3%)	Reference
Second quartile (12–26% uninsured)	66 (25%)	−1.5% (−4.2%, 1.1%)	4.2% (1.9%, 6.6%)	5.8% (5.3%, 6.3%)	<0.001
Third quartile (26–45% uninsured)	66 (25%)	−8.2% (−10.2%, −6.1%)	1.7% (0.2%, 3.2%)	9.8% (9.1%, 10.6%)	<0.001
Highest quartile (>45% uninsured)	65 (25%)	−20.3% (−22.9%, −17.8%)	−1.7% (−3.1%, −0.2%)	18.9% (17.2%, 20.6%)	<0.001

Authors' interpretation of data from the NIS, 2010.
*Includes all NIS-sampled facilities treating greater than 100 non-elderly adult trauma patients (n = 263).

reimbursement. Future analyses of the impacts of cuts to DSH funding on trauma centers now have a reasonable national benchmark for comparison.

There are a number of limitations inherent to the data and the study design that must be considered when interpreting our results. First, there are no nationally available data detailing payer-specific reimbursement rates for trauma care and such reimbursement rates vary not only between, but within payer groups. To ensure that our findings were not driven by the reimbursement to costs ratios used in our primary model, we conducted a variety of analyses using different reimbursement ratios derived from recent peer-reviewed literature and found very similar results, with all three analyses producing reimbursement gains of over one billion dollars (see Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/TA/A896). Second, it important to note that our analyses only consider charges, costs, and reimbursements for hospitals, not for physicians. The impact of changes in trauma patient payer mix on individual providers will vary according to a number of factors that are outside of the scope of the current analysis. Third, our analysis does not take into account the 2010 Dependent Coverage Provision, which allows young adults to obtain coverage from a parent's private health insurance plan through the age of 26. This provision led to a significant reduction in the uninsured rate among young adult trauma patients,[30] but it was not accounted for in our model. Not accounting for this provision in our model could underestimate the proportion of 19 to 26 year olds who would gain private insurance coverage. Next, we assumed that 75% of patients eligible for coverage would actually enroll in insurance plans. We chose this estimate as a midpoint between the variety of estimates that we encountered in the literature.[18] However, a trauma patients include a subpopulation often perceived as risk takers, and so we also tested lower alternative enrollment rates to determine the impact of this parameter on our finding. Ultimately, these sensitivity analyses demonstrated very similar results (see Supplemental Table 2, Supplemental Digital Content 1, http://links.lww.com/TA/A896). Finally, policy changes occur in real-time and data lag associated with population-based claims data such as those that we relied on with NIS make real-time analyses infeasible. As such, we have used the best available data sources to establish reasonable estimates of potential effects of ongoing policy changes. However, real-world implementation ACA-related policies may result in unanticipated variations from the best data presently available. Wide state-to-state variation in healthcare marketplace enrolment, changes in the number and quality of available commercial insurance products, changes in labor force participation have all been highlighted as potential challenges that make it difficult to predict the ultimate impact of the ACA in insurance coverage expansion. We will not know the full impact of the law's insurance coverage expansion policies for a few more years, and deviations from the assumptions we relied on in our model could result in different coverage estimated than those predicted by our analyses. Specifically, lower than projected enrollment in either Medicaid or private insurance plans could lead to a higher proportion of nonelderly adults remaining uninsured and subsequently a smaller increase in reimbursement. However, the most recent data from the Centers for Disease Control reveal that the overall uninsured rate in the US has fallen from 16% in 2010 to 8.9% as of June 2016[31]—a number that is already approaching our projected uninsured rate of appriximately 8%. Also, an early analysis of a level 1 trauma center in Arizona

showed that in the first 6 months after local implementation of the ACA, found that the unisnured rate fell from 23.3% pre-ACA to 8.2% post-ACA.[32] This analysis also reported an approximately 13% increase in trauma-related reimbursement, which is qualitatively similar to our estimated 9.3% increase in margin. These are among the earliest results specifically focused on trauma patients and data that is both more nationally-reresentative and that includes a longer-term post-ACA study period are needed.

Historically, hospitals have often supported trauma centers by virtue of their beneficial impact of patient outcomes[33–36] and the additional benefits that they bring despite the large amounts of margin-negative care. However, a 2015 position statement from the American College of Surgeons noted that recent health economic changes have made trauma centers more financially beneficial and, in some markets, this has led to a proliferation of trauma centers beyond the needs of the populace.[31] Establishment of trauma centers for reasons other than population-level needs can result in dilution of trauma care across too many centers and the loss of the volume-outcome benefit[35]—as has recently been demonstrated.[37] Meanwhile, other patient populations may be left without access to a critically needed trauma center. The possibility that reimbursement for trauma care may measurably improve as more patients gain health insurance has the potential to exacerbate this worrying trend. These issues highlight the need for guidelines such as those proposed by the American College of Surgeons Committee on Trauma, which state that trauma center designation should be "based upon the needs of the population being served, rather than the needs of individual health care organizations or hospital groups."[31]

Overall, efforts to reduce the number of Americans without health insurance is expected to result in significantly improved reimbursement for trauma care, which could total more than one billion dollars per year nationally. Notably, these changes will not be experienced equally across all hospitals. The hospitals that stand to gain the most from insurance coverage expansion are those that are already caring for the highest proportion of uninsured and minority patients. These anticipated changes in payer-mix could have a marked, positive effects on both the lives of trauma patients as well as the financial viability of many of the hospitals these patients rely on for lifesaving care.

AUTHORSHIP

J.W.S., P.U.N., P.A.N., T.C.T., K.W.S., M.G.S., D.C.C., A.S., and A.H.H. all contributed to the concept and design of this project as well as acquisition, analysis, or interpretation of data. J.W.S. and P.U.N., drafted the article and P.A.N., T.C.T., K.W.S., M.G.S., D.C.C., A.S., and A.H.H. each provided critical revision of the manuscript for important intellectual content. J.W.S., P.U.N., P.A.N., T.C.T., K.W.S., and M.G.S. worked on the statistical analyses and D.C.C., A.S., and A.H.H. all provided support and supervision. J.W.S. had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

DISCLOSURE

J.W.S., P.U.N., P.A.N., K.W.S., D.M.C., and A.S. have no relevant disclosures.
T.C.T. serves on the advisory board for SeamlessMobile Health and has received consulting fees from Verisk Health.
M.G.S. has received speaking fees from Ethicon research funding from General Electric for their Safe Surgery 2020 project.
A.H.H. is the PI of a contract (AD-1306-03980) with the Patient-Centered Outcomes Research Institute entitled "Patient-Centered Approaches to Collect Sexual Orientation/Gender Identity in the ED" and a Harvard Surgery Affinity Research Collaborative (ARC) Program Grant entitled "Mitigating Disparities Through Enhancing Surgeons' Ability To Provide Culturally Relevant Care." A.H.H. is also the co-founder and an equity holder in Patient Doctor Technologies Inc., which owns and operates the website www.doctella.com.
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DISCUSSION

Dr. L.D. Britt (Norfolk, Virginia): Let me first commend Dr. Scott and Dr. Haider and the co-authors for providing me a very well-written manuscript. Now, not being a political person, I would, nevertheless, be remiss if I did not compliment the Obama administration for forging ahead with the health reform initiative.

The authors focus on a relevant and pressing issue for this organization and this specialty, acute care surgery. The overarching aim of the authors' investigation was to analytically assess the impact of the Affordable Care Act on hospital reimbursement for trauma care.

Just for further clarification, Title I of ACA expands the opportunities for people, especially low-income individuals, to purchase private health insurance with Title II expanding Medicaid to include those who are indigent and under the age of 65. Ostensibly, those measures provide health insurance to an additional 20 million predominantly underprivileged Americans.

Because a large percentage of trauma victims lack insurance coverage, it is predicted and expected that there will, invariably, be substantial and favorable payment for those medical facilities providing trauma care.

Based on their findings, the authors underscore that their data suggests that insurance coverage expansion has the potential to improve trauma centers' financial viability and their ability to provide care for their communities.

Unfortunately, the authors failed to clearly describe how the predicting probabilities were actually utilized. In addition, the authors did not provide an adequate description of the probabilistic micro-simulation model that they propose. Because of these concerns I have several poignant questions for the authors.

Why was the study model using 2010 data? Why not use actual data after implementation of the Affordable Care Act? I know you said it takes time for it to come but at the end of the day not using the actual data after implementation or post-implementation of the ACA could invalidate your findings.

How was the high deductible for insurance exchange plans actually factored into your analysis? As you know, some of these deductibles can go up to $5,500 per individual.

Does your 175% enrollment estimate contain an age/gender bias? I suspect that young males are not enrolling for insurance as they are healthy, and it is better economically for them to pay the penalty rather than the insurance premium. This group, as you would expect, is more at risk for trauma injuries than the older group.

Why did you assume that 12% of the uninsured population were non-U.S. citizens and not eligible for the insurance coverage? This obviously is based on geography, i.e., Texas versus Vermont. Your comments on that.

With there being a known variation of payor rates for trauma based on the insurance plan, the facility, the region, et cetera, can the generalized data be utilized to determine the true impact on selected sites?

And to make our discussions today even more contemporary, how will the withdrawal of United Health Care and other insurance companies standing in line to pull out of this system from the insurance exchange programs impact the trauma center reimbursements?

And, finally, and most importantly, a pundit—and I'm not that pundit—could assert that the gain that you highlight for trauma centers at a post-ACA margin of 1.4% is an incredibly small increment or delta. A change in just one assumption could

wipe that gain out and more. How would the authors address those concerns?

Again, I want to commend the authors for tackling a tough problem and I want to thank the Association for the privilege of the floor.

Dr. Enrique Ginzburg (Miami, Florida): I commend actually the Committee to put a paper of this nature on and I commend the authors in putting it together. However, you didn't tell the whole story.

It seems like there are more people insured according to the data, but what hasn't been demonstrated is that with the amount of people that have been insured there has been an increase, as per the Census Bureau, in the rate of poverty in the U.S. due to this type of insurance program since there are more people that are insured but have to pay out of their pocket much more for medicines, visits, and hospitalization.

So in reality when it comes to trauma and the liability that trauma has with the costs—I just spent three days a few weeks ago in the hospital and they charged me $25,000 for just some IVs and IV antibiotics— I can only tell you that the only solution for trauma, which is catastrophic for any family—especially if someone gets injured with a TBI or whatever—that is spend 3-4 weeks in the hospital or even a few months—is for everyone in this nation to have catastrophic insurance for trauma. And I would like to hear your comment on that.

Dr. John W. Scott (Boston, Massachusetts): Thank you very much for your attention and the questions. I will try to go as quickly as I can.

Thank you, Dr. Britt, for your comments. Why 2010 data? We wanted a true pre-post. Due to the gradual implementation and incremental roll out it's almost impossible.

A lot of states didn't start their Medicaid expansion until 2014 and those data aren't even available for the NIS. And so there is not really a true pre- other than before the law was signed.

The concern of increasing deductibles in the exchange plans, it is a brand-new market that has never existed in America before and so there is a lot of churn and a lot of turnover.

Overall what the data that were released actually last week show, though, is that most of the gains are happening in that non-group, non-employer expansion market. So it's happening.

There are going to be bumps in the road and it's in some markets that's true but it's not true in all markets. And it will continue to be challenging but I think overall the data are showing that those plans are working.

The 75% enrollment age/gender bias, exactly. We shared your same concern on that issue. If you look at who is gaining coverage, younger males, exactly, are not signing up. That's why our data are different than the data that come from Kaiser Family Foundation and stuff that don't look specifically at trauma patients.

It's going to be an issue but it's why things like Medicaid expansion, it's a way to identify people who could benefit from having increased coverage and aren't yet signed up would probably be a good thing.

The 12% non-U.S. citizens, that's just based on demographics. We don't have very good data to assume is that number higher for trauma patients or not. It probably is a little bit higher, but we figured that would bias our results just by taking them out entirely.

The change in payor rates by regionality is exactly right. We ran three different types of reimbursement ratio models and they all generated about the same results. So though each of these small specifications can make a difference, none of them made a large difference in what our actual outcome was.

For withdrawal of United Health Care, similarly, it doesn't mean that these folks don't have opportunity to buy insurance. They're losing maybe in some markets more premium plans but trauma is always covered. It's one of the ten essentials, so even the worst private coverage out there is much better than no coverage.

I think that sort of goes to the last question here that the counterfactual is just having no coverage. So even if you have really, you know, minimal coverage, because trauma is in the ten essentials it's night-and-day better than not being covered at all.

The question of the 1.5% margin, yes, that's a slim margin but it's much better than minus eight, so it's actually a 9% change in margin. And I think if any hospital administrator could find something that would increase margin by 9% in their division, they would be happy with that.

Lastly, Dr. Ginzburg, thank you for bringing up your comment. In fact we have another analysis we've done on catastrophic expenditure risk which is like a WHO metric that we haven't really used in the U.S., applying it to trauma patients.

You are spot on. Essentially 8–9 out of 10 trauma patients are at risk for catastrophic health care spending just by admission. And so that's why going from any bit—from uninsured to any coverage, again, because trauma is included in that ten essentials—is really beneficial.

So bottom line is more coverage is better for patients and is better for facilities. It doesn't matter how you do it or the politics behind it, but getting folks covered is probably going to be a good thing.

Thank you very much.