Downwardly Mobile

The Accidental Cost of Being Uninsured

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Hypothesis: Given the pervasive evidence of disparities in screening, hospital admission, treatment, and outcomes due to insurance status, a disparity in outcomes in trauma patients (in-hospital death) among the uninsured may exist, despite preventive regulations (such as the Emergency Medical Treatment and Active Labor Act).

Design: Data were collected from the National Trauma Data Bank from January 1, 2002, through December 31, 2006 (version 7.0). We used multiple logistic regression to compare mortality rates by insurance status.

Setting: The National Trauma Data Bank contains information from 2.7 million patients admitted for traumatic injury to more than 900 US trauma centers, including demographic data, medical history, injury severity, outcomes, and charges.

Patients: Data from patients (age, ≥18 years; n=687 091) with similar age, race, injury severity, sex, and injury mechanism were evaluated for differences in mortality by payer status.

Main Outcome Measure: In-hospital death after blunt or penetrating traumatic injury.

Results: Crude analysis revealed a higher mortality for uninsured patients (odds ratio [OR], 1.39; 95% confidence interval [CI], 1.36-1.42; $P<.001$). Controlling for sex, race, age, Injury Severity Score, Revised Trauma Score, and injury mechanism (adjusted for clustering on hospital), uninsured patients had the highest mortality (OR, 1.80; 95% CI, 1.61-2.02; $P<.001$). Subgroup analysis of young patients unlikely to have comorbidities revealed higher mortality for uninsured patients (OR, 1.89; 95% CI, 1.66-2.15; $P<.001$), as did subgroup analyses of patients with head injuries (OR, 1.65; 95% CI, 1.42-1.90; $P<.001$) and patients with 1 or more comorbidities (OR, 1.52; 95% CI, 1.30-1.78; $P<.001$).

Conclusions: Uninsured Americans have a higher adjusted mortality rate after trauma. Treatment delay, different care (via receipt of fewer diagnostic tests), and decreased health literacy are possible mechanisms.

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THE CENTERS FOR DISEASE Control and Prevention estimate that in 2004, there were 112 012 deaths related to unintentional injuries alone in the United States.[1] Unintentional injury is within the top 10 causes of death for every age group and is the leading cause of death among persons aged 1 to 44 years. Motor vehicle crash is the most common cause of unintentional injury, whereas fall is the most common cause of nonfatal injury overall.[2]

See Invited Critique at end of article

In 2007, according to the US Census Bureau, 45.7 million Americans (15.3%) were uninsured.[3] The US Congressional Budget Office estimates that another 10 million Americans will become uninsured in the next 10 years.[4] Uninsured patients currently face health-related disparities in screening, hospital admission, treatment, and outcomes. A Virginia study showed that insured patients were twice as likely to report being screened for colorectal cancer compared with uninsured counterparts of similar ages.[5] In Arizona, California, and Texas, the odds of admission to specialty hospitals (for acute myocardial infarction, congestive heart failure, coronary revascularization, and coronary artery bypass graft surgery) were significantly higher for insured patients, after adjustment for demographics, comorbidities, and distance from the hospital.[6] In a recent study,[7] uninsured patients with breast cancer presented with significantly larger tumors, higher levels of disease severity, lower rates of operations for disease, and lower rates of breast reconstruction than insured patients.

Uninsured adults have a 25% higher risk of mortality than insured adults, accounting for approximately 18 000 deaths per year in excess.[8,9] Evidence regarding the effects of lack of insurance on traumatically injured patients suggests that they are at added risk. A study using the National Inpatient Sample[10] found that organ donors were more likely to be uninsured. A 1994 study of acutely injured Massachusetts patients[11] indicated that uninsured patients were less likely to undergo operations, received fewer services, and had higher odds of in-hospital death. A recent study of adult trauma[12] found that insurance status was an independent predictor of death subsequent to trauma. However, that study did not account for the likely increased prevalence of comorbidities and worse overall health status in uninsured patients, which may have contributed to residual confounding.

Given the pervasive evidence of disparities due to insurance status and the limited data on the effect of comorbidities in the traumatically injured population, we hypothesized that subgroup analyses of national data would reveal a disparity in trauma outcome (in-hospital death) among the uninsured.

METHODS

Data were provided by the National Trauma Data Bank (NTDB) (version 7.0), which contains data from 2.7 million admitted patients from more than 900 US trauma centers (from January 1, 2002, through December 31, 2006). As of 2002, there were 1154 trauma centers in the United States.[13] Trauma center participation in the NTDB is voluntary, and thus these data are a convenience sample. The NTDB contains information on patient demographics, preexisting comorbidities, emergency department care, complications, injury severity, patient outcomes, hospital charges, and hospital information.[14]

We included data on adult patients (aged ≥18 years) who had been injured via blunt or penetrating trauma (we excluded patients with burns). Patients were divided into the following categories of insurance coverage: uninsured (includes self-pay), a managed care organization, commercial indemnity insurance (including automobile insurance, Blue Cross/Blue Shield, no-fault insurance, worker's compensation, or another commercial indemnity plan), Medicare, and Medicaid, for a total of 5 categories. Patients with insurance in categories that did not naturally fall into our set categories or who represented less than 1% in the data set were excluded (not done/not documented [11.7%], organ donor subsidy [<1%], other [19.9%], pending [<1%], Maternal and Child Health/Crippled Children's programs [<1%], private charity [<1%], no charge [1.2%], Civilian Health and Medical Program of the Uniformed Services [<1%], and government/military [<1%]).

We performed multiple logistic regression using commercially available software (Stata IC, version 10; StataCorp, College Station, Texas) to analyze differences in in-hospital mortality (the dependent variable) by insurance status (the independent variable). We report odds ratios (ORs), *P* values, and 95% confidence intervals (CIs). We initially performed a crude analysis of mortality vs insurance status and mortality vs each of the a priori hypothesized confounders (sex, race, age, Injury Severity Score [ISS], and Revised Trauma Score [RTS]), trauma center level (combined American College of Surgeons verification and state designation), and mechanism of injury (blunt or penetrating), and then adjusted for each of these a priori hypothesized confounders. Clustering within hospital facility was adjusted for using generalized estimating equations. We used clustered Pearson χ^2 tests to compare categorical variables and clustered linear regression to compare continuous demographic variables.

Age was divided into quartiles before missing data were deleted because of the nonlinear relationship between trauma mortality and age. Patients older than 89 years (n=24 479) in the database were recoded as 94.3 years of age based on the 2004 Centers for Disease Control and Prevention life table average life expectancy for all persons older than 89 years of age. For race, we included patients with a documented race defined as white (non-Hispanic origin), black, Hispanic, or other (patients documented as Asian or Pacific Islander and Native American or Alaskan Native).

The ISS is an algorithm that provides an overall score for patients with multiple injuries. Each injury is assigned an Abbreviated Injury Scale score[15] and is allocated to 1 of 6 body regions (ie, the head, face, chest, abdomen, extremities [including the pelvis], and external). The highest Abbreviated Injury Scale score in each body region is used. The 3 most severely injured body regions have their scores squared and added together to produce the ISS. The ISS ranges from 0 to 75. If an injury is assigned an Abbreviated Injury Scale of 6 (ie, an unsurvivable injury), the ISS is automatically 75. The ISS correlates with mortality, morbidity, hospital stay, and other measures of severity.[16,17] The relationship of mortality and ISS is nonlinear; thus, we treated the ISS as a categorical variable (0-8, 9-15, and >15).[16] The RTS is a measure of physiologic injury severity and includes the Glasgow Coma Scale, systolic blood pressure, and respiratory rate; it ranges from 0 to 8, with 8 portending the highest probability of survival.[18] The RTS has been shown to predict mortality in patients with blunt and penetrating trauma.

We performed subgroup analyses on the following 3 groups of patients: (1) those aged 18 to 30 years (to investigate patients with a lower prevalence of comorbidities), (2) those with information in the NTDB on 1 or more preexisting comorbidities, and (3) those who had sustained head injuries (per the Abbreviated Injury Scale code). In the subgroup analysis of patients aged 18 to 30 years, age was treated as a continuous variable. In the NTDB, preexisting comorbidities are recorded at the time of patient arrival in the emergency department. The number of comorbidities was counted, and this variable was treated as continuous in this subgroup analysis.

RESULTS

The NTDB contained 1 861 779 patients. Those younger than 18 years (n=358 705) were excluded. After the remaining inclusion criteria were satisfied, 72.0% of patients had complete data on our chosen variables (n=687 091). Patients with missing data were found to be similar to included patients in terms of baseline characteristics. For the estimates of the multivariate regression model variables to be unbiased, the probability of being missing can depend on the covariates but not the outcome; this appears to hold for these data. Therefore, this analysis based on 687 091 patients should possess minimal bias.[19] Patient characteristics are given in **Table 1**. Patients were likely to be male (65.9%) and white (66.9%), with a mean age of 45.4 years. The overall mortality rate was 4.7%.

Uninsured patients had higher mortality than did insured patients overall in the crude (unadjusted) analysis (OR, 1.39; 95% CI, 1.36-1.42; $P<.001$). Using white race as a reference category, all other races had higher odds of being uninsured, including 3.29 (95% CI, 3.25-3.34; $P<.001$) for black patients, 4.36 (95% CI, 4.29-4.43; $P<.001$) for Hispanic patients, and 1.60 (95% CI, 1.57-1.64; $P<.001$) for those of other races. Male patients

Table 1. Demographics[a]

Characteristic	Overall	Insurance Coverage				
		Commercial	MCO	Medicare	Medicaid	None
Male	65.9	68.5	65.3	44.4	63.8	79.7
Race[b]						
White	66.9	74.3	75.6	85.1	52.1	47.7
Black	15.5	9.8	9.9	7.9	27.3	24.9
Hispanic	11.3	8.5	9.0	2.6	12.7	21.0
Other	6.3	7.4	5.5	4.4	7.8	6.4
Age, mean (SD), y	45.4 (20.5)	41.4 (16.7)	42.4 (16.9)	72.4 (14.0)	36.8 (14.9)	34.7 (13.0)
ISS, mean (SD)	10.4 (9.8)	11.0 (10.1)	10.3 (9.6)	10.4 (8.2)	11.0 (10.4)	9.7 (10.4)
RTS, mean (SD)	7.36 (1.5)	7.40 (1.5)	7.45 (1.4)	7.51 (1.2)	7.24 (1.7)	7.21 (1.8)
Blunt injury	87.3	93.8	90.9	96.3	79.3	75.9
Head injury	34.2	36.2	33.1	30.6	36.1	34.7
Mortality	4.7	3.3	2.9	6.7	3.7	5.7

Abbreviations: ISS, Injury Severity Score; MCO, managed care organization; RTS, Revised Trauma Score.
[a]For comparison of insurance groups for all characteristics, $P < .001$. Pearson χ^2 tests (adjusted for clustering on hospital) were used for categorical variables, and linear regression (adjusted for clustering on hospital) was used for continuous variables. Unless otherwise indicated, data are expressed as percentage of patients.
[b]Percentages have been rounded and may not total 100.

Table 2. Multiple Logistic Regression Results[a]

Independent Variable Subcategory	Unadjusted		Adjusted[b]	
	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Sex				
Female	1 [Reference]		1 [Reference]	
Male	1.37 (1.34-1.41)	<.001	1.15 (1.10-1.21)	<.001
Race				
White	1 [Reference]		1 [Reference]	
Black	1.27 (1.23-1.31)	<.001	1.18 (1.07-1.29)	.001
Hispanic	0.92 (0.88-0.95)	<.001	0.92 (0.68-1.24)	.57
Other	0.90 (0.85-0.94)	<.001	1.07 (0.95-1.20)	.27
Age, y				
Q1 (18-28)	1 [Reference]		1 [Reference]	
Q2 (29-42)	0.87 (0.84-0.90)	<.001	1.08 (1.03-1.13)	.001
Q3 (43-60)	1.01 (0.97-1.04)	.67	1.78 (1.67-1.90)	<.001
Q4 (>60)	1.90 (1.84-1.95)	<.001	6.30 (5.59-7.11)	<.001
Insurance type				
Commercial	1 [Reference]		1 [Reference]	
MCO	0.88 (0.84-0.93)	<.001	0.93 (0.82-1.06)	.28
Medicaid	1.13 (1.08-1.19)	<.001	0.92 (0.80-1.05)	.19
Medicare	2.09 (2.03-2.16)	<.001	1.56 (1.42-1.70)	<.001
Uninsured	1.78 (1.73-1.84)	<.001	1.80 (1.61-2.02)	<.001
ISS				
0-8	1 [Reference]		1 [Reference]	
9-15	2.39 (2.27-2.51)	<.001	2.47 (2.12-2.88)	<.001
>15	24.18 (23.19-25.21)	<.001	15.40 (12.46-19.04)	<.001
Injury mechanism				
Blunt	1 [Reference]		1 [Reference]	
Penetrating	1.53 (1.51-1.55)	<.001	1.69 (1.61-1.77)	<.001
RTS				
Continuous	0.54 (0.53-0.54)	<.001	0.55 (0.53-0.57)	<.001

Abbreviations: CI, confidence interval; ISS, Injury Severity Score; MCO, managed care organization; OR, odds ratio; Q, quartile; RTS, Revised Trauma Score.
[a]The dependent variable was death.
[b]Adjusted for all covariates in the table and for clustering on hospital.

had higher odds of being uninsured than did female patients (OR, 2.57; 95% CI, 2.54-2.60; $P < .001$).

Table 2 gives the values of the unadjusted and adjusted logistic regression results of the main analysis. The final adjusted model (using in-hospital death as the dependent variable) included insurance type (using commercial insurance as a reference), ISS (using ISS of 0-8 as a reference), race (using white as a reference), age (using the youngest quartile as a reference), sex (male compared with female), RTS (continuous), and injury mecha-

Table 3. Multiple Logistic Regression Results by Subgroup[a]

Independent Variable Subcategory	Patients Aged 18-30 y: Adjusted[b] OR (95% CI)	Patients Aged 18-30 y: P Value	Head-Injured Patients: Adjusted[b] OR (95% CI)	Head-Injured Patients: P Value	Patients With Comorbidities: Adjusted[b] OR (95% CI)	Patients With Comorbidities: P Value
Sex						
Female	1 [Reference]		1 [Reference]		1 [Reference]	
Male	1.02 (0.92-1.13)	.76	1.01 (0.95-1.08)	.70	1.22 (1.13-1.32)	<.001
Race						
White	1 [Reference]		1 [Reference]		1 [Reference]	
Black	1.44 (1.26-1.66)	<.001	1.15 (1.01-1.31)	.04	0.99 (0.90-1.09)	.87
Hispanic	1.06 (0.85-1.34)	.59	1.09 (0.94-1.26)	.24	1.18 (0.92-1.51)	.20
Other	1.24 (1.03-1.48)	.02	1.20 (0.99-1.45)	.06	0.89 (0.70-1.12)	.32
Age, y						
Continuous	0.99 (0.99-1.01)	.83	...	...	...	...
Q1 (18-28)	...	...	1 [Reference]		1 [Reference]	
Q2 (29-42)	...	...	1.12 (1.03-1.21)	.007	1.19 (1.02-1.39)	.03
Q3 (43-60)	...	...	1.89 (1.71-2.07)	<.001	2.10 (1.80-2.45)	<.001
Q4 (>60)	...	...	5.71 (5.00-6.52)	<.001	5.87 (4.78-7.21)	<.001
Insurance type						
Commercial	1 [Reference]		1 [Reference]		1 [Reference]	
MCO	0.89 (0.71-1.12)	.32	0.93 (0.80-1.09)	.38	0.92 (0.80-1.05)	.22
Medicaid	0.72 (0.60-0.87)	.001	0.84 (0.70-1.01)	.07	0.99 (0.84-1.15)	.86
Medicare	1.09 (0.78-1.52)	.62	1.57 (1.37-1.81)	<.001	1.33 (1.21-1.46)	<.001
Uninsured	1.89 (1.66-2.15)	<.001	1.65 (1.42-1.90)	<.001	1.52 (1.30-1.78)	<.001
ISS						
0-8	1 [Reference]		1 [Reference]		1 [Reference]	
9-15	2.03 (1.58-2.60)	<.001	2.59 (2.20-3.05)	<.001	2.45 (2.10-2.85)	<.001
>15	19.42 (14.26-26.46)	<.001	15.53 (13.03-18.50)	<.001	12.61 (10.44-15.22)	<.001
Injury mechanism						
Blunt	1 [Reference]		1 [Reference]		1 [Reference]	
Penetrating	1.99 (1.89-2.10)	<.001	2.18 (2.02-2.36)	<.001	1.45 (1.32-1.60)	<.001
RTS						
Continuous	0.50 (0.48-0.52)	<.001	0.56 (0.54-0.58)	<.001	0.61 (0.58-0.65)	<.001
No. of comorbidities						
Continuous	...	...	...	...	1.17 (1.15-1.20)	<.001

Abbreviations: CI, confidence interval; ellipses, not applicable; ISS, Injury Severity Score; MCO, managed care organization; OR, odds ratio; Q, quartile; RTS, Revised Trauma Score.

[a] The dependent variable was death.

[b] Adjusted for all covariates in the table and for clustering on hospital.

nism (penetrating compared with blunt). Two variables on trauma center level comparing levels III and IV with levels I and II and comparing level I with levels II, III, and IV were separately added to the multivariate model but did not change any results and were not significant. They were not included in the final analysis.

In the final model, uninsured patients had the highest odds of death (OR, 1.80; 95% CI, 1.61-2.02; $P<.001$). Black patients had higher odds of death compared with white patients (OR, 1.18; 95% CI, 1.07-1.29; $P=.001$). Older patients had higher odds of mortality compared with younger patients. Patients with a higher ISS had higher odds of mortality compared with patients in the lowest ISS group. Penetrating injury resulted in an increased odds of mortality compared with blunt injury. As the RTS increased, the odds of death decreased.

Results of subgroup analyses on the cohort of patients aged 18 to 30 years (n = 209 702) are shown in **Table 3**. This group was chosen because of the likelihood of fewer (or no) comorbidities in younger patients. Uninsured patients in this group still had the highest odds of death (OR, 1.89; 95% CI, 1.66-2.15; $P<.001$). Subgroup analysis of head-injured patients (n = 134 483) also revealed higher mortality for the uninsured (OR, 1.65; 95% CI, 1.42-1.90; $P<.001$) (Table 3), as did subgroup analysis of patients with information in the NTDB on 1 or more comorbidities (OR, 1.52; 95% CI, 1.30-1.78; $P<.001$) (Table 3). The **Figure** displays a comparison of the adjusted odds of death by payer status for each analysis.

COMMENT

Uninsured trauma patients in the NTDB had a statistically significant higher adjusted odds of mortality compared with insured trauma patients. Our subgroup analyses strongly corroborated these findings. In younger patients (aged 18-30 years), the adjusted odds of mortality after trauma remained higher for uninsured patients compared with insured patients, indicating that the differences persist in a relatively healthy cohort. In the subgroup analyses of head-injured patients and those with 1 or more comorbidities in the NTDB, the adjusted odds of mortality in the uninsured population remained significantly high.

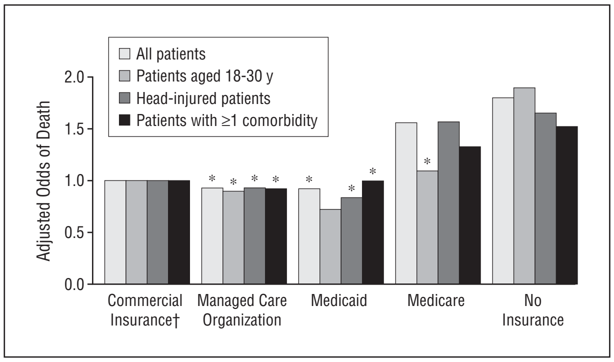

Figure. Adjusted odds of death by payer status. Odds are adjusted for sex, race, age, Injury Severity Score, Revised Trauma Score, injury mechanism, and clustering on hospital facility. *$P > .05$ (not significant). †Reference category.

Lack of insurance may affect mortality by several mechanisms because payer status can affect many processes of care. First, uninsured patients may experience treatment delay, thus contributing to the observed increased odds of mortality due to trauma. The purpose of the Emergency Medical Treatment and Active Labor Act (passed in 1986) is to ensure that payer status would not sway a hospital's decision to provide emergent care; it states that a patient may not be transferred from one hospital to another or refused necessary treatment when medically unstable.[20] A study of pediatric orthopedic injuries[21] found that children insured by Medicaid, those receiving charity care, and those who were uninsured experienced a delay in care for injuries when compared with privately insured children. In addition, a higher percentage of publicly insured and uninsured children had visited multiple emergency departments and hospitals before being treated definitively. A 2006 study of the NTDB[22] revealed that minorly injured (ISS, 0-3) uninsured patients and those insured by Medicaid (compared with commercially insured patients) were more likely to be transferred to a level I trauma center after controlling for confounders such as comorbidities, age, sex, and others. The same finding was also elucidated in another study of patients who had sustained femur fractures.[23] A significant delay in definitive care of transferred patients could increase the number of missed injuries or complications and prolong the hospital stay.

Second, uninsured patients may receive different care than insured patients. Despite the Emergency Medical Treatment and Active Labor Act, hospitalized trauma patients were found to have differences in care based on payer (insurance) status; uninsured trauma patients were less likely to be admitted to the hospital and received fewer services during their admission compared with insured trauma patients.[11] A study[24] of 16 562 emergency department visits (in patients with similar ISS) at a single tertiary care teaching hospital showed that, although uninsured and insured patients were treated similarly in terms of the number of laboratory tests ordered, whether they received consultations, and the length of stay in the emergency department, uninsured patients received significantly fewer radiographic studies and were less likely to be admitted compared with insured patients with similar diagnoses.

Physicians may not be cognizant that they are providing different care to the uninsured. Different care may be due in part to geographic sorting of patients more than practice differences within institutions. Furthermore, institutions providing treatment to a higher proportion of uninsured patients may simply have fewer resources for care. Another recent study[25] found that, after adjusting for comorbidities, age, injury severity, physiology, and ethnicity, uninsured trauma patients were less likely to be transferred to a rehabilitation facility, thus indicating that uninsured patients are also receiving different aftercare than their insured counterparts.

Third, uninsured patients may possess a lower rate of health literacy and may have less aptitude in communication with physicians and other treating team members.[26,27] As a result, clinical outcomes may suffer. Patients with a higher rate of health literacy may communicate symptoms better, have readier family involvement in care, and have more dialogues with their health care providers, which may assist with improving quality of care. Communication failures have been shown to adversely affect patient safety.[28]

The NTDB has limitations. According to its documentation,

> It includes a disproportionate number of larger hospitals with younger and more severely injured patients. The data may not be representative of all trauma hospitals in the nation and thus do not allow statistically valid inferences about national injury incidence and prevalence.[14]

Likewise, the proportion of insured and uninsured patients in the database may not be representative of the United States today.

The data within the NTDB were incomplete in terms of comorbidity reporting; therefore, we were unable to take this into account in our main analysis. Although some data existed on patients with 1 or more comorbidities, no data existed on patients with no comorbidities. As a result, it was unclear whether missing comorbidity status was equivalent to no comorbidities or to truly missing comorbidities. It is conceivable that uninsured patients may have a higher prevalence of untreated preexisting illnesses such as diabetes mellitus or hypertension. This likelihood could contribute to mortality and unmeasured confounding. Our subgroup analysis of patients aged 18 to 30 years addressed this point because younger persons tend to have fewer (or no) comorbidities, and we found that the odds of mortality were still highest in the subset of uninsured patients in the fully adjusted model. Our subgroup analysis of patients with information on comorbidities in the NTDB also corroborated and confirmed the finding of higher adjusted mortality in uninsured patients.

Most recent research has concentrated on decreased (or lack of) access to care as a result of being uninsured. However, we found that, even after admission to a hospital, trauma patients can have worse outcomes based on insurance status. This concerning finding warrants more rigorous investigation to determine why such variation in mortality would exist in a system where equivalent care is not only expected but mandated by law. In addition, treatment often is initiated before payer status is recognized; thus, this provokes the question of whether differences exist in processes of care during the hospital stay. We can only speculate as to the mechanism of the disparities we have exposed; the true causes are still unclear. Although the lack of insurance may not be the only explanation for the disparity in trauma mortality, the accidental costs of being uninsured in the United States today may be too high to continue to overlook.

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REFERENCES

1. Centers for Disease Control and Prevention. FastStats: Death and Mortality. http://www.cdc.gov/nchs/fastats/deaths.htm. Accessed February 19, 2008.
2. Centers for Disease Control and Prevention. Data and statistics: ten leading causes of death and injury (charts). http://www.cdc.gov/ncipc/osp/charts.htm. Accessed February 19, 2008.
3. United States Census Bureau. Income, poverty, and health insurance coverage in the United States: 2007. http://www.census.gov/prod/2008pubs/p60-235.pdf. Updated August 2008. Accessed March 31, 2009.
4. The USA's crisis of the uninsured. *Lancet*. 2009;373(9666):782. doi:10.1016/S0140-6736(09)60457-8.
5. de Bosset V, Atashili J, Miller W, Pignone M. Health insurance–related disparities in colorectal cancer screening in Virginia. *Cancer Epidemiol Biomarkers Prev*. 2008;17(4):834-837.
6. Cram P, Pham HH, Bayman L, Vaughan-Sarrazin MS. Insurance status of patients admitted to specialty cardiac and competing general hospitals: are accusations of cherry picking justified? *Med Care*. 2008;46(5):467-475.
7. Coburn N, Fulton J, Pearlman DN, Law C, DiPaolo B, Cady B. Treatment variation by insurance status for breast cancer patients. *Breast J*. 2008;14(2):128-134.
8. Franks P, Clancy CM, Gold MR. Health insurance and mortality: evidence from a national cohort. *JAMA*. 1993;270(6):737-741.
9. Sorlie PD, Johnson NJ, Backlund E, Bradham DD. Mortality in the uninsured compared with that in persons with public and private health insurance. *Arch Intern Med*. 1994;154(21):2409-2416.
10. Herring AA, Woolhandler S, Himmelstein DU. Insurance status of US organ donors and transplant recipients: the uninsured give, but rarely receive. *Int J Health Serv*. 2008;38(4):641-652.
11. Haas JS, Goldman L. Acutely injured patients with trauma in Massachusetts: differences in care and mortality, by insurance status. *Am J Public Health*. 1994;84(10):1605-1608.
12. Haider AH, Chang DC, Efron DT, Haut ER, Crandall M, Cornwell EE III. Race and insurance status as risk factors for trauma mortality. *Arch Surg*. 2008;143(10):945-949.
13. MacKenzie EJ, Hoyt DB, Sacra JC, et al. National inventory of hospital trauma centers. *JAMA*. 2003;289(12):1515-1522.
14. American College of Surgeons Committee on Trauma. National Trauma Data Bank (NTDB) Version 7.0. Chicago, IL: American College of Surgeons Committee on Trauma; 2007.
15. Association for the Advancement of Automotive Medicine. *The Abbreviated Injury Scale 1990—Update 98*. Barrington, IL: Association for the Advancement of Automotive Medicine; 1990.
16. Baker SP, O'Neill B, Haddon W Jr, Long WB. The Injury Severity Score: a method for describing patients with multiple injuries and evaluating emergency care. *J Trauma*. 1974;14(3):187-196.
17. Baker SP, O'Neill B. The Injury Severity Score: an update. *J Trauma*. 1976;16(11):882-885.
18. Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A revision of the trauma score. *J Trauma*. 1989;29(5):623-629.
19. Zhao LP, Lipsitz S, Lew D. Regression analysis with missing covariate data using estimating equations. *Biometrics*. 1996;52(4):1165-1182.
20. Frequently asked questions about the Emergency Medical Treatment and Active Labor Act (EMTALA). http://www.emtala.com/faq.htm. Accessed February 19, 2008.
21. Sabharwal S, Zhao C, McClemens E, Kaufmann A. Pediatric orthopaedic patients presenting to a university emergency department after visiting another emergency department: demographics and health insurance status. *J Pediatr Orthop*. 2007;27(6):690-694.
22. Koval KJ, Tingey CW, Spratt KF. Are patients being transferred to level-I trauma centers for reasons other than medical necessity? *J Bone Joint Surg Am*. 2006;88(10):2124-2132.
23. Archdeacon MT, Simon PM, Wyrick JD. The influence of insurance status on the transfer of femoral fracture patients to a level-I trauma center. *J Bone Joint Surg Am*. 2007;89(12):2625-2631.
24. White FA, French D, Zwemer FL Jr, Fairbanks RJ. Care without coverage: is there a relationship between insurance and ED care? *J Emerg Med*. 2007;32(2):159-165.
25. Nirula R, Nirula G, Gentilello LM. Inequity of rehabilitation services after traumatic injury. *J Trauma*. 2009;66(1):255-259.
26. Wallace LS, Cassada DC, Rogers ES, et al. Can screening items identify surgery patients at risk of limited health literacy? *J Surg Res*. 2007;140(2):208-213.
27. Baker DW, Parker RM, Williams MV, et al. The health care experience of patients with low literacy. *Arch Fam Med*. 1996;5(6):329-334.
28. Greenberg CC, Regenbogen SE, Studdert DM, et al. Patterns of communication breakdowns resulting in injury to surgical patients. *J Am Coll Surg*. 2007;204(4):533-540.

INVITED CRITIQUE

Trauma of the Uninsured

This article is especially relevant given the priority assigned to health care reform by the current administration. Clearly, one of the more significant problems in our current health care system is that of the uninsured and their relative lack of access to care.

However, one might assume that lack of access would be less of a problem with emergency and trauma care, since all patients entering an emergency department or a trauma center are guaranteed to receive care regardless of their ability to pay. It is the providers, hospitals and physicians, who