

BACKGROUND

Approximately 3.6 million elderly persons in the US receive treatment for blunt or penetrating trauma each year; 63,000 of these patients require hospitalization and more than 23,000 die as a result of their injuries.¹ No recent study has estimated the direct costs of blunt and penetrating trauma among the elderly from a managed care perspective.

OBJECTIVES

- Estimate per patient charges for resources utilized by elderly managed care enrollees with inpatient admission for blunt or penetrating trauma.
- Assess incremental financial impact by comparing charges incurred during post-discharge medical encounters to those incurred prior to initial injury.

METHODS

Study Design

Retrospective claims analysis.

Data Source

i3 Innovus LabRx database: Enrollment, medical, and pharmacy claims from a large US health plan.

Inclusion Criteria:

- Age ≥ 65
- ≥ 1 ICD-9-CM diagnosis code consistent with blunt or penetrating trauma between 1/1/2003 and 2/1/2005.
 - TBI: ICD-9-CM codes, 800 - 801.9, 803 - 804.9, and 850 - 854.1 regardless of mortality; 873.0 - 873.9, 905.0, and 907.0 for cases resulting in death.²
 - Other traumas: ICD-9 codes 802, 805-807, 808-809, 860-869, or 900-904.
- Diagnosis required during either inpatient admission or emergency department visit for which hospital admission followed.
- Continuous plan enrolment for ≥ 6 months prior to and following index hospitalization.

Analysis strata:

- Trauma type: (1) Isolated TBI; (2) other trauma with TBI (T+TBI); and (3) other trauma without TBI (T-TBI).
- Injury severity: ICDMAP-90 software³ used to assign Injury Severity Score (ISS). ISS categories (1-9, 10-15, 16-24, and 25+) reflect increasing severity.
- Trauma center designation of admitting hospital: Assigned using linked data from the American Hospital Association (AHA).

Outcome Measure:

- Per patient charges during 6-month following initial injury.
- Incremental financial impact of trauma: Difference between per patient charges incurred during 6-months prior to initial injury and during post-discharge medical encounters.

RESULTS

Patient Characteristics (Table 1):

- 3,274 patients met all inclusion criteria
- 555 (17%) had isolated TBI, 239 (7%) had T+TBI, and 2,480 (76%) had T-TBI.
- In T-TBI cohort, 82% had low severity injuries (ISS 1-9).
- In T+TBI cohort, 43% had severe (ISS 16-24) or critical (ISS 25+) injuries.
- T+TBI cohort had highest proportion of admissions to a Level I or II trauma center (42%) and lowest proportion admitted to a non-trauma center (53%).
- 61% of subjects were admitted to a non-trauma center.

Index Hospitalization (Table 2):

- Mean length of stay (LOS) and intensive care unit (ICU) were highest (11.6 and 4.8 days, respectively) among patients with T+TBI
- LOS and ICU days decreased from Level I to Level III/IV trauma centers.

The Direct Economic Burden of Blunt and Penetrating Trauma Among the Elderly Population

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—Table 1. Characteristics of the Study Sample—

	Study Cohort							
	All Patients (N = 13,274; 100%)		Isolated TBI (N = 555; 16.95%)		T+TBI (N = 239; 7.30%)		T-TBI (N = 2,480; 75.75%)	
	N	%	N	%	N	%	N	%
Age Category								
65 - 69	468	14.29	103	18.56	50	20.92	315	12.70
70 - 74	539	16.46	92	16.58	47	19.67	400	16.13
75 - 79	632	19.30	91	16.40	35	14.64	506	20.40
≥ 80	1,635	49.94	269	48.47	107	44.77	1,259	50.77
Mean Age (Years)	79.36		78.97		77.95		79.58	
Gender								
Female	2,011	61.42	321	57.84	128	53.56	1,562	62.98
Male	1,262	38.55	234	42.16	111	46.44	917	36.98
Missing	1	0.03	0	0.00	0	0.00	1	0.04
Injury Severity Score (ISS)								
1-9	2,388	72.94	286	51.53	77	32.22	2,025	81.65
10-15	333	10.17	35	6.31	53	22.18	245	9.88
16-24	315	9.62	179	32.25	73	30.54	63	2.54
25+	71	2.17	10	1.80	30	12.55	31	1.25
Unable to Score	167	5.10	45	8.11	6	2.51	116	4.68
Mean ISS	8.15		9.81		14.85		7.14	
Trauma Level of Admitting Hospital								
I	468	14.29	81	14.59	56	23.43	331	13.35
II	592	18.08	101	18.20	44	18.41	447	18.02
III/IV	206	6.29	28	5.05	12	5.02	166	6.69
Level Unknown	4	0.12	1	0.18	1	0.42	2	0.08
Not Trauma Ctr	2,004	61.21	344	61.98	126	52.72	1,534	61.85

—Table 2. Descriptive Summary of Index Hospitalization—

	Study Cohort							
	All Patients		Isolated TBI		T+TBI		T-TBI	
	Mean LOS	Mean ICU Days	Mean LOS	Mean ICU Days	Mean LOS	Mean ICU Days	Mean LOS	Mean ICU Days
All Patients	7.56	1.76	6.35	1.76	11.59	4.78	7.45	1.47
ISS at Initial Injury								
1-9	6.66	1.11	4.91	1.12	7.95	2.10	6.86	1.07
10-15	9.69	2.57	7.06	0.91	10.57	3.55	9.88	2.60
16-24	10.56	4.44	8.11	2.98	14.73	6.74	12.71	5.95
25+	15.07	7.28	15.50	4.30	15.30	8.37	16.16	7.19
Unable to Score	7.11	2.06	5.89	1.04	10.50	8.17	7.41	2.14
Trauma Center Level								
I	8.38	2.26	7.48	1.85	11.00	5.02	8.16	1.90
II	7.66	1.85	6.91	1.74	13.43	6.36	7.26	1.43
III/IV	5.80	0.63	4.46	1.14	10.00	2.67	5.72	0.40
Level Unknown	4.50	1.75	4.00	4.00	4.00	3.00	5.00	0.00
Not Trauma Ctr	7.53	1.73	6.08	1.78	11.41	4.33	7.54	1.51

—Table 3. Mean Total Charges per Patient by Study Cohort—

Study Cohort	Index Hospitalization	Post-Discharge Medical Encounters		
		Subsequent Hospitalizations	Outpatient & Other Ancillary	Pharmacy
All Patients	\$27,148	\$8,055	\$12,662	\$1,334
Isolated TBI	\$21,837	\$8,513	\$10,955	\$1,210
T+TBI	\$54,893	\$8,281	\$13,447	\$1,180
T-TBI	\$25,662	\$7,931	\$12,968	\$1,377

RESULTS (continued)

Per patient charges (Tables 3-4 and Figures 1-2)

- In T+TBI, index hospitalization charges were more than double (\$54,893) those incurred for isolated TBI (\$21,837) or T-TBI (\$25,662).
- Outpatient and other ancillary services represented the majority of post-discharge medical charges.
- Subsequent hospitalization charges varied within a narrow range (\$6,841 to \$8,434) across trauma cohorts.
- Outpatient and ancillary charges ranged from \$8,883 to \$13,309.
- Pharmacy charges were modest.
- Charges for overall post-discharge care were \$9,450 higher per patient than charges incurred over the entire 6-month period prior to initial injury.
- Difference in pre- to post-injury charges, excluding index hospitalization, was greatest (\$14,187; +163%) among T+TBI patients.

—Table 4. Pre- to Post-Injury Mean Total Charges—

Study Cohort	Total	Inpatient Services*	Outpatient & Other Ancillary	Pharmacy
6 Months Pre-Injury				
All Patients	\$12,601	\$4,615	\$6,813	\$1,172
Isolated TBI	11,471	3,840	6,549	1,082
T+TBI	8,720	2,408	5,137	1,176
T-TBI	13,228	5,002	7,034	1,192
Post-Discharge (<6 months)[†]				
All Patients	\$22,051	\$8,055	\$12,662	\$1,334
Isolated TBI	20,678	8,513	10,955	1,210
T+TBI	22,908	8,281	13,447	1,180
T-TBI	22,276	7,931	12,968	1,377
Increase				
All Patients	\$9,450 (+75%)	\$3,439 (+75%)	\$5,848 (+86%)	\$161 (+14%)
Isolated TBI	9,207 (+80%)	4,673 (+122%)	4,405(+67%)	128 (+12%)
T+TBI	14,187 (+163%)	5,873 (+244%)	8,310 (+162%)	4 (+0.35%)
T-TBI	9,048 (+68%)	2,929 (+59%)	5,933 (+84%)	184 (+15%)

* Excludes index hospitalization.

[†] Data for inpatient services, outpatient and other ancillary, and pharmacy repeated from Table 3.

Figure 1. Mean total charges per patient incurred during 6-month post-injury period, by study cohort and injury severity score (ISS)

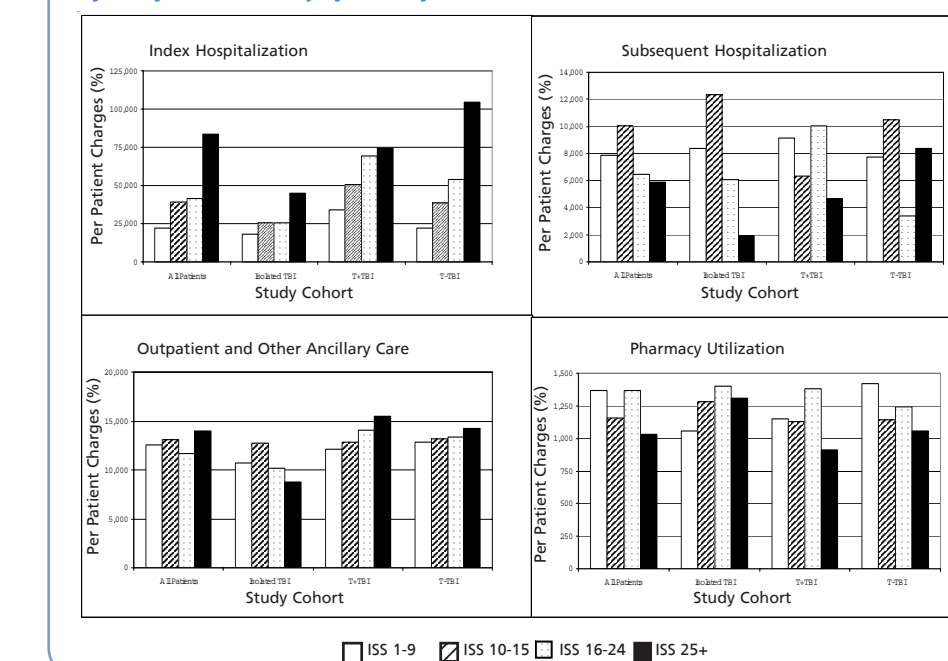
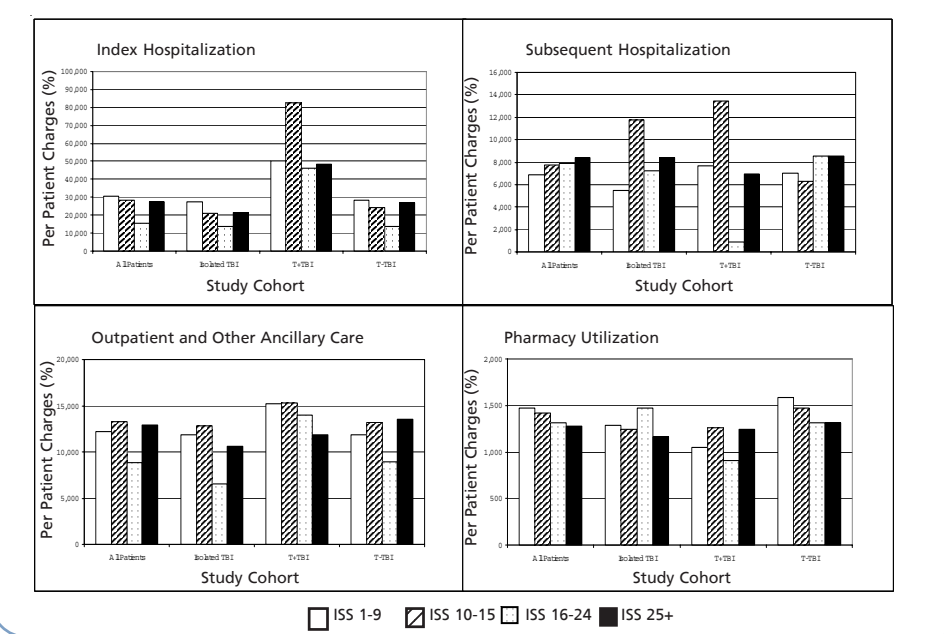


Figure 2. Mean total charges per patient incurred during 6-month post-injury period, by study cohort and trauma center level of the admitting hospital



LIMITATIONS

- Misclassification bias due to the claim dates.
- Data are from a single health plan; generalizability of results is therefore uncertain.
- Cost data represent charges rather than actual payments.
- Discharge status and external injury cause codes (E-codes) were unreliably recorded in the claims data; therefore unable to provide context in regard to these parameters.

CONCLUSIONS

- The direct economic burden of blunt and penetrating trauma in elderly patients to third-party payors is substantial.
- Results highlight the substantially higher charges associated with combined TBI and other trauma (T+TBI).
- TBI contributes dramatically to elderly trauma patients' injury severity, whether alone or in combination with other trauma.
- Results provide insight regarding the degree to which trauma systems are functioning in a managed care environment.

ACKNOWLEDGMENTS

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