

Supplemental Digital Content - Table 1: Clinical Adherence Indicators Evaluated for All 4 Treatment locations - Pre-hospital (PH), Emergency Department (ED), Operating Room (OR), and Intensive Care Unit (ICU).

Indicators	Definition and coding	PH Indicator (n=5)	ED Indicator (n=5)	OR Indicator (n=10)	ICU Indicator (n=14)
1. Direct transfer to pediatric trauma center	0 = Not direct transfer 1 = Direct transfer	X			
2. Hypoxia treated in 30 minutes after onset <i>Condition: Hypoxia</i>	0 = Hypoxic and not treated with O2 0 = Hypoxic and treated >30 minutes 1 = Hypoxic but treated with O2 ≤ 30 minutes 2 = No hypoxia (All SaO ₂ -normal)	X	X	X	X
3. Supplemental oxygen administered	0 = No 1 = Yes	X	X	X	X
4. Systemic hypotension treated within 30 min of admission <i>Condition: Hypotension</i>	0 = Hypotensive and not treated 0 = Hypotensive and treated >30 minutes after hypotension onset 1 = Hypotensive but treated in ≤ 30 minutes 2 = No hypotension	X	X	X	X
5. Hypertonic saline or Mannitol for high ICP <i>Condition: High ICP</i>	0 = Neither hypertonic saline nor Mannitol provided for patient with high ICP 1 = Hypertonic saline or Mannitol provided for patient with high ICP 2 = No high ICP	X	X	X	X
6. Fever control T<38.5C	0 = Any Temperature ≥ 38.5C 1 = All Temperature < 38.5C		X	X	X
7. All CPP>40mmHg	0 = Any CPP ≤ 40mmHg 1 = All CPP > 40mmHg			X	X

8. ICP monitoring within 4 hours of admission	0 = No ICP monitoring 0 = ICP monitoring provided > 4 hours after center admission 1 = ICP monitoring provided ≤ 4 hours after center admission				X
9. Neuromuscular blockade monitored <i>Condition: NM Blockade given</i>	0 = NMB not monitored 1 = NMB monitored 2 = No Neuromuscular blockade given			X	X
10. Normocarbica in the absence of herniation and Hypocarbica in the presence of herniation	0= PaCO ₂ >30 mmHg, cerebral herniation present 0= PaCO ₂ ≤ 30 mmHg, no cerebral herniation 1 =PaCO ₂ ≤ 30 mmHg, cerebral herniation present 1 =PaCO ₂ >30 mmHg, no cerebral herniation				X
11. External ventricular drain (EVD) used for high ICP <i>Condition: high ICP</i>	0 = EVD not used <i>with high ICP</i> 1 = EVD used <i>with high ICP</i> 2 = No high ICP			X	X
12.Barbiturates used for high ICP <i>Condition: High ICP</i>	0 = No barbiturates used <i>with high ICP</i> 1 = Barbiturates used <i>with high ICP</i> 2 = No high ICP			X	X
13.Antiepileptic medication to prevent early seizures	0 = No anti-epileptics administered 1 = Anti-epileptics administered				X
14.Steroids not used	0 = Steroids administered 1= Steroids not administered				X

15.Nutrition started in 72 hours after ICU admission	0 = Nutrition not started 0 = Nutrition start >72 hours after ICU admission 1 = Nutrition start ≤ 72 hours after ICU admission				X
16.Decompressive Craniectomy(DC) for high ICP or/and SDH or/and EDH or/and cerebral edema within 48hrs of admission to trauma center Condition: High ICP or/and SDH or/and EDH or/and cerebral edema	0=DC not performed <i>for</i> high ICP <i>or/and</i> SDH <i>or/and</i> EDH <i>or/and</i> cerebral edema 1=DC performed for high ICP <i>or/and</i> SDH <i>or/and</i> EDH <i>or/and</i> cerebral edema 2=No high ICP <i>or /and</i> SDH <i>or/and</i> EDH <i>or/and</i> cerebral edema			X	

Prehospital (PH) includes EMS (flight + ambulance or ambulance only) and Index hospital combined.

EDH = epidural hematoma, SDH = Subdural hematoma;

*Systemic hypotension definition= systolic blood pressure < 70 + 2 (age [years]).

0 = Non-adherence, 1= Adherence, 2 = N/A. Some indicators are conditional as indicated above.

** For each patient and indicator, lack of adherence received a value of 0 for that indicator and adherence received a value of 1. For adherence indicators relevant to a subset of patients (e.g., provision of hypertonic saline or mannitol is relevant to patients with high ICP), a third category with a value of two was added to accommodate patients for whom adherence was not relevant (Table 1).

X –Indicator is applicable in that specific location

Supplemental Digital Content - Table 2: Clinical Characteristics of 236 Children with Severe Traumatic Brain Injury across Five Study Centers (Total and by Each Study Center). Procedures performed in 72 hours after admission.

	Total n=236 N(%)	Center 1 n=50 N(%)	Center 2 n=42 N(%)	Center 3 n=40 N(%)	Center 4 n=56 N(%)	Center 5 n=48 N(%)
Age (years) mean[SD]	8.0[6.3]	8.5[5.6]	3.3[4.8]	6.7[6.1]	11.2[6.1]	9.0[5.9]
Gender						
Male	163(69.1)	32(64.0)	26(61.9)	27(67.5)	41(73.2)	37(77.1)
Female	73(30.9)	18(36.0)	16(38.1)	13(32.5)	15(26.8)	11(22.9)
Race						
White	117(49.6)	37(74.0)	9(21.4)	31(77.5)	35(62.5)	5(10.4)
Latino	47(19.9)	0	15(35.7)	1(2.5)	8(14.3)	23(47.9)
Black	55(23.3)	10(20.0)	14(33.3)	6(15.0)	7(12.5)	18(37.5)
Asian	6(2.5)	0	0	0	4(7.1)	2(4.2)
Other	11(4.7)	3(6.0)	4(9.5)	2(5.0)	2(3.6)	0
Injury mechanism						
Fall	37(15.7)	7(14.0)	7(16.7)	2(5.0)	12(21.4)	9(18.8)
Motor vehicle crash	51(21.6)	7(14.0)	3(7.1)	13(32.5)	20(35.7)	8(16.7)
Struck by vehicle	50(21.2)	9(18.0)	3(7.1)	5(12.5)	14(25.0)	19(39.6)
Abusive TBI	60(25.4)	13(26.0)	25(59.5)	13(32.5)	2(3.6)	7(14.6)
Gunshot	14(5.9)	2(4.0)	2(4.8)	4(10.0)	3(5.4)	3(6.3)
Sport/Recreation	15(6.4)	9(18.0)	1(2.4)	1(2.5)	2(3.6)	2(4.2)
Other	9(3.8)	3(6.0)	1(2.4)	2(5.0)	3(5.4)	0(0.0)
Transportation						
Private vehicle	4(1.7)	0	0	4(10.0)	0	0
Flight	47(19.9)	25(50.0)	4(9.5)	17(42.5)	1(1.8)	0
Ambulance	145(61.4)	20(40.0)	38(90.5)	18(45.0)	21(37.5)	48(100)
Flight/Ambulance	40(17.0)	5(10.0)	0	1(2.5)	34(60.7)	0

Transfer care						
None	5(2.1)	0	0	4(10.0)	0	1(2.1)
BLS	27(11.5)	0	9(21.4)	3(7.5)	0	15(31.3)
ALS	165(70.2)	48(98.0)	33(78.6)	24(60.0)	41(73.2)	19(39.6)
ALS+BLS	38(16.2)	1(2.0)	0	9(22.5)	15(26.8)	13(27.1)
Glasgow coma scale score (admit motor)						
6	4(1.7)	0	0	2(5.0)	1(1.8)	1(2.1)
5	39(16.5)	19(38.0)	6(14.3)	2(5.0)	4(7.1)	8(16.7)
4	43(18.2)	8(16.0)	13(31.0)	4(10.0)	2(3.6)	16(33.3)
3	21(8.9)	9(18.0)	1(2.4)	3(7.5)	3(5.4)	5(10.4)
2	11(4.7)	6(12.0)	1(2.4)	2(5.0)	0	2(4.2)
1, not para	20(8.5)	4(8.0)	0(0.0)	1(2.5)	2(3.6)	13(27.1)
1, para	98(41.5)	4(8.0)	21(50.0)	26(65.0)	44(78.6)	3(6.3)
Direct from scene						
No	111(47.0)	27(54.0)	36(85.7)	20(50.0)	24(42.9)	4(8.3)
Yes	125(53.0)	23(46.0)	6(14.3)	20(50.0)	32(57.1)	44(91.7)
Head abbreviated injury severity score (AIS)						
3	28(11.9)	2(4.0)	14(33.3)	4(10.0)	4(7.1)	4(8.3)
4	80(33.9)	20(40.0)	25(59.5)	16(40.0)	6(10.7)	13(27.1)
5	125(53.0)	27(54.0)	3(7.1)	19(47.5)	45(80.4)	31(64.6)
6	3(1.3)	1(2.0)	0	1(2.5)	1(1.8)	0
Injury severity score mean[SD]	28.3[12.8]	29.5[12.8]	17.4[6.5]	26.9[12.3]	37.3[12.8]	27.2[9.2]

Non head MAXAIS						
0	54(22.9)	8(16.0)	19(45.2)	5(12.5)	1(1.8)	21(43.8)
1	58(24.6)	15(30.0)	7(16.7)	18(45.0)	14(25.0)	4(8.3)
2	36(15.3)	10(20.0)	10(23.8)	6(15.0)	4(7.1)	6(12.5)
3	60(25.4)	13(26.0)	5(11.9)	7(17.5)	24(42.9)	11(22.9)
4	22(9.3)	3(6.0)	1(2.4)	2(5.0)	10(17.9)	6(12.5)
5	5(2.1)	0	0	2(5.0)	3(5.4)	0
6	1(0.4)	1(2.0)	0	0	0	0
ICU length of stay (days) mean[SD]	14.8[12.2]	15.8[9.8]	11.6[11.6]	13.0[9.9]	10.9[8.5]	22.4[16.5]
Extracranial injury						
No	66(28.0)	7(14.0)	19(45.2)	15(37.5)	8(14.3)	17(35.4)
Yes	170(72.0)	43(86.0)	23(54.8)	25(62.5)	48(85.7)	31(64.6)
Injury location						
Face	106(44.9)	30(60.0)	10(23.8)	12(30.0)	37(66.1)	17(35.4)
Neck	10(4.2)	2(4.0)	1(2.4)	0	7(12.5)	0
Thorax	67(28.4)	13(26.0)	7(16.7)	8(20.0)	29(51.8)	10(20.8)
Abdomen	48(20.3)	12(24.0)	4(9.5)	2(5.0)	23(41.1)	7(14.6)
Spine	20(8.5)	4(8.0)	0	2(5.0)	13(23.2)	1(2.1)
Extremities	112(47.5)	30(60.0)	10(23.8)	19(47.5)	30(53.6)	23(47.9)
All head computed tomograph diagnoses						
Epidural hematoma	40(17.0)	12(24.0)	6(14.3)	4(10.0)	10(17.9)	8(16.7)
Subdural Hematoma	157(66.5)	36(72.0)	30(71.4)	29(72.5)	35(62.5)	27(56.3)
Subarachnoid Hemorrhage	108(45.8)	19(38.0)	8(19.1)	20(50.0)	33(58.9)	28(58.3)

Intracerebral Hemorrhage	74(31.4)	10(20.0)	6(14.3)	10(25.0)	29(51.8)	19(39.6)
Intraventricular Hemorrhage	47(19.9)	7(14.0)	3(7.1)	7(17.5)	21(37.5)	9(18.8)
Cerebral edema	127(53.8)	34(68.0)	12(28.6)	32(80.0)	31(55.4)	18(37.5)
Cerebral infarction	39(16.5)	13(26.0)	10(23.8)	2(5.0)	10(17.9)	4(8.3)
Contusion	94(39.8)	30(60.0)	8(19.1)	6(15.0)	26(46.4)	24(50.0)
Diffuse axonal	70(30.0)	18(36.0)	8(19.1)	5(12.5)	30(53.6)	9(18.8)
TBI history						
Yes	1(0.4)	1(2.0)	0	0	0	0
Medical condition						
Yes	46(19.5)	20(40.0)	3(7.1)	2(5.0)	8(14.3)	13(27.1)
Medical condition list						
Cardiac	2(0.9)	1(2.0)	0	1(2.5)	0	0
Pulmonary	19(8.1)	4(8.0)	1(2.4)	0	4(7.1)	10(20.8)
Neurology	4(1.7)	2(4.0)	2(4.8)	0	0	0
Endocrine	1(0.4)	0	0	0	1(1.8)	0
Other	25(10.6)	15(30.0)	1(2.4)	1(2.5)	4(7.1)	4(8.3)
Any surgery						
No	114(48.3)	16(32.0)	23(54.8)	24(60.0)	25(44.6)	26(54.2)
Yes	122(51.7)	34(68.0)	19(45.2)	16(40.0)	31(55.4)	22(45.8)
Decompressive craniectomy						
No	51(41.8)	19(55.9)	8(42.1)	2(12.5)	20(64.5)	2(9.1)
Yes	71(58.2)	15(44.1)	11(57.9)	14(87.5)	11(35.5)	20(90.9)

In-hospital death						
No	206(87.3)	40(80.0)	37(88.1)	31(77.5)	51(91.1)	47(97.9)
Yes	30(12.7)	10(20.0)	5(11.9)	9(22.5)	5(8.9)	1(2.1)
Discharge disposition						
Home	41(17.4)	7(14.0)	8(19.1)	10(25.0)	7(12.5)	9(18.8)
Outpatient rehabilitation	2(0.8)	0	1(2.4)	1(2.5)	0	0
Inpatient rehabilitation	134(56.8)	33(66.0)	26(61.9)	19(47.5)	24(42.9)	32(66.7)
Skilled nursing facility	14(5.9)	0	2(4.8)	1(2.5)	10(17.9)	1(2.1)
Another facility	15(6.4)	0	0	0	10(17.9)	5(10.4)
Dead	30(12.7)	10(20.0)	5(11.9)	9(22.5)	5(8.9)	1(2.1)
Discharge Glasgow outcome scale score						
Dead	30(12.7)	10(20.0)	5(11.9)	9(22.5)	5(8.9)	1(2.1)
Alive but vegetative	20(8.5)	4(8.0)	1(2.4)	2(5.0)	12(21.4)	1(2.1)
Alive with major impairment	114(48.3)	20(40.0)	20(47.6)	10(25.0)	36(64.3)	28(58.3)
Alive with min/mod impairment	56(23.7)	16(32.0)	5(11.9)	19(47.5)	2(3.6)	14(29.2)
Alive with baseline functioning	16(6.8)	0	11(26.2)	0	1(1.8)	4(8.3)

Supplemental Digital Content - Table 3: Detailed Clinical Characteristics and Adherence Rate of 236 Children with Severe Traumatic Brain Injury across Five Study Centers by Glasgow Outcome Scale [GOS] score.

	Total N (%)	GOS 1 N (%)	GOS 2 N (%)	GOS 3 N (%)	GOS 4 N (%)	GOS 5 N (%)	<i>P</i> value
Number of patients	236(100)	30(12.7)	20 (8.5)	114 (48.3)	56 (23.7)	16 (6.8)	
Total adherence rate mean[SD]	72.8[8.9]	69.1[9.9]	72.6[10.3]	72.7[8.8]	74.9[8.1]	73.3[6.8]	0.15
Age (years) mean[SD]	8.0[6.3]	5.0[6.1]	9.6[6.3]	9.0[6.1]	7.5[6.0]	6.7[6.4]	<0.0001
Gender							0.45
Male	163(69.1)	21(70.0)	8(40.0)	85(74.6)	37(66.1)	12(75.0)	
Female	73(30.9)	9(30.0)	12(60.0)	29(25.4)	19(33.9)	4(25.0)	
Race							NA
White	117(49.6)	21(70.0)	11(55.0)	51(44.7)	31(55.4)	3(18.8)	
Latino	47(19.9)	3(10.0)	3(15.0)	29(25.4)	6(10.7)	6(37.5)	
Black	55(23.3)	5(16.7)	3(15.0)	26(22.8)	17(30.4)	4(25.0)	
Asian	6(2.5)	0(0.0)	2(10.0)	2(1.7)	0(0.0)	2(12.5)	
Other	11(4.7)	1(3.3)	1(5.0)	6(5.3)	2(3.6)	1(6.3)	
Injury mechanism							NA
Fall	37(15.7)	3(10.0)	5(25.0)	13(11.4)	10(17.9)	6(37.5)	
Motor vehicle crash	51(21.6)	3(10.0)	8(40.0)	28(24.6)	11(19.6)	1(6.2)	
Struck by vehicle	50(21.2)	4(13.3)	3(15.0)	31(27.2)	10(17.9)	2(12.5)	
Abusive TBI	60(25.4)	14(46.7)	1(5.0)	25(21.9)	15(26.8)	5(31.2)	
Gunshot	14(5.9)	3(10.0)	1(5.0)	6(5.3)	3(5.4)	1(6.3)	
Sport/Recreation	15(6.3)	1(3.3)	0(0.0)	8(7.0)	5(8.9)	1(6.2)	
Other	9(3.9)	2(6.7)	2(10.0)	3(2.6)	2(3.6)	0(0.0)	

Transportation to study (trauma) center							NA
Private vehicle	4(1.7)	1(3.3)	0(0.0)	1(0.9)	2(3.6)	0(0.0)	
Ambulance	145(61.4)	16(53.3)	8(40.0)	72(63.2)	34(60.7)	15(93.8)	
Flight/Ambulance	87(36.9)	13(43.4)	12(60.0)	41(35.9)	20(35.7)	1(6.2)	
Highest pre-hospital transportation certification from scene to study center, including first hospital							NA
None	5(2.1)	1(3.3)	0(0.0)	1(0.9)	3(5.4)	0(0.0)	
BLS	27(11.5)	0(0.0)	0(0.0)	18(15.9)	6(10.7)	3(18.8)	
ALS/ALS+BLS	203(86.4)	29(96.7)	20(100)	94(83.2)	47(83.9)	13(81.2)	
Glasgow coma scale score (admit motor)							NA
6	4(1.7)	0(0.0)	0(0.0)	2(1.8)	2(3.6)	0(0.0)	
5	39(16.5)	2(6.7)	4(20.0)	14(12.3)	15(26.8)	4(25.0)	
4	43(18.2)	1(3.3)	0(0.0)	21(18.4)	17(30.4)	4(25.0)	
3	21(8.9)	2(6.7)	1(5.0)	10(8.8)	7(12.5)	1(6.3)	
2	11(4.7)	2(6.7)	2(10.0)	6(5.3)	1(1.8)	0(0.0)	
1, not paralyzed	20(8.5)	5(16.7)	0(0.0)	15(13.2)	0(0.0)	0(0.0)	
1, paralyzed	98(41.5)	18(60.0)	13(65.0)	46(40.4)	14(25.0)	7(43.8)	
Direct from scene							0.03
No	111(47.0)	22(73.3)	10(50.0)	44(38.6)	24(42.9)	11(68.8)	
Yes	125(53.0)	8(26.7)	10(50.0)	70(61.4)	32(57.1)	5(31.2)	
Head abbreviated injury severity score (AIS)							NA
3	28(11.9)	3(10.0)	0(0.0)	14(12.3)	8(14.3)	3(18.8)	
4	80(33.9)	4(13.3)	4(20.0)	35(30.7)	27(48.2)	10(62.5)	
5	125(53.0)	20(66.7)	16(80.0)	65(57.0)	21(37.5)	3(18.8)	
6	3(1.3)	3(10.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	

Injury severity score mean[SD]	28.3[12.8]	34.1[18.5]	36.4[12.3]	29.2[11.7]	23.5[8.3]	17.1[5.9]	<0.0001
Non head MAXAIS							NA
0	54(22.9)	5(16.7)	1(5.0)	23(20.2)	13(23.2)	12(75.0)	
1	58(24.6)	10(33.3)	5(25.0)	24(21.0)	17(30.4)	2(12.5)	
2	36(15.2)	5(16.7)	1(5.0)	16(14.0)	12(21.4)	2(12.5)	
3	60(25.4)	8(26.7)	8(40.0)	33(29.0)	11(19.6)	0(0.0)	
4	22(9.3)	1(3.3)	4(20.0)	15(13.2)	2(3.6)	0(0.0)	
5	5(2.1)	0(0.0)	1(5.0)	3(2.6)	1(1.8)	0(0.0)	
6	1(0.4)	1(3.3)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	
ICU length of stay (days) mean[SD]	14.8(12.2)	8.2(9.0)	24.1(11.9)	16.7(13.7)	12.8(8.4)	8.8(6.8)	<0.0001
Extracranial injury							0.45
No	66(28.0)	9(30.0)	1(5.0)	30(26.3)	16(28.6)	10(62.5)	
Yes	170(72.0)	21(70.0)	19(95.0)	84(73.7)	40(71.4)	6(37.5)	
Injury location							
Face	106(44.9)	17(56.7)	10(50.0)	58(50.9)	17(30.4)	4(25.0)	0.34
Neck	10(4.2)	2(6.7)	1(5.0)	6(5.3)	1(1.8)	0(0.0)	0.70*
Thorax	67(28.4)	8(26.7)	10(50.0)	37(32.5)	11(19.6)	1(6.3)	0.21
Abdomen	48(20.3)	6(20.0)	8(40.0)	26(22.8)	7(12.5)	1(6.3)	0.66
Spine	20(8.5)	4(13.3)	2(10.0)	12(10.5)	2(3.6)	0(0.0)	0.30*
Extremities	112(47.5)	12(40.0)	11(55.0)	59(51.8)	28(50.0)	2(12.5)	0.35
All head computed tomography diagnoses							
Epidural hematoma	40(17.0)	6(20.0)	3(15.0)	16(14.0)	9(16.1)	6(37.5)	0.03
Subdural hematoma	157(66.5)	25(83.3)	15(75.0)	69(60.5)	39(69.6)	9(56.3)	0.56
Subarachnoid hemorrhage	108(45.8)	20(66.7)	10(50.0)	57(50.0)	18(32.1)	3(18.8)	0.51
Intracerebral hemorrhage	74(31.4)	7(23.3)	10(50.0)	36(31.6)	16(28.6)	5(31.3)	0.40
Intraventricular hemorrhage	47(19.9)	6(20.0)	9(45.0)	26(22.8)	6(10.7)	0(0.0)	0.004*

Cerebral edema	127(53.8)	26(86.7)	18(90.0)	59(51.8)	24(42.9)	0(0.0)	<0.0001*
Cerebral infarction	39(16.5)	7(23.3)	7(35.0)	18(15.8)	6(10.7)	1(6.3)	0.33
Contusion	94(39.8)	10(33.3)	9(45.0)	49(43.0)	19(33.9)	7(43.8)	0.31
Diffuse axonal injury	70(29.7)	4(13.3)	11(55.0)	46(40.4)	8(14.3)	1(6.3)	0.01
Surgery							0.20
No	114(48.3)	17(56.7)	6(30.0)	54(47.4)	30(53.6)	7(43.8)	
Yes	122(51.7)	13(43.3)	14(70.0)	60(52.6)	26(46.4)	9(56.2)	
Decompressive Craniectomy							0.04*
No DC for high ICP or SDH or EDH or cerebral edema	44(36.1)	2(15.4)	5(35.7)	29(48.3)	7(26.9)	1(11.1)	
DC for high ICP or SDH or EDH or cerebral edema	71(58.2)	11(84.6)	9(64.3)	25(41.7)	18(69.2)	8(88.9)	
No high ICP or SDH or EDH or cerebral edema	7(5.7)	0(0.0)	0(0.0)	6(10.0)	1(3.9)	0(0.0)	

*p values are corrected by the design (cluster in hospitals). In cells with 0 values, p values could not be determined and are denoted by NA. For the dichotomized variables which had 0 cell, *Fisher's Exact test was used (no clustering). Data as mean (SD). GOS 1 = dead, GOS 2 = vegetative state, GOS 3 = major impairment, GOS 4 = minor impairment, GOS 5 = pre-injury baseline

Supplemental Digital Content - Table 4: Adherence Scorecard for Severe Pediatric Traumatic Brain Injury Indicators across Five Study Centers by Location (Pre-hospital [PH], Emergency Department [ED], Operating Room [OR] and Intensive Care Unit [ICU]). Pre-hospital data (N=219) and ED data (N=224). 122/236 subjects underwent surgery in the first 72 hours after TBI contributing to OR data. N =236 for ICU.

		Total (n=236) %	Center 1 (n=50) %	Center 2 (n=42) %	Center 3 (n=40) %	Center 4 (n=56) %	Center 5 (n=48) %
Total Adherence Rate (%)		73	76	68	73	69	78
PH Indicators (n=5)	Indicator	(n=219) %	(n=47) %	(n=42) %	(n=32) %	(n=55) %	(n=43) %
Indicator 1	Direct transfer	49.8	42.6	14.3	37.5	56.4	93
Indicator 2*	hypoxia treated in 30 minutes after onset	93.8	100	100	50	100	100
Indicator 3	Supplemental oxygen administered	97.8	95.7	100	93.8	100	97.7
Indicator 4*	systemic hypotension treated within 30 minutes of admission**	88.6	77.8	87.5	83.3	100	50.0
Indicator 5	Hypertonic saline or mannitol for high ICP	64.7	90.9	72.7	60.0	50.0	50.0
PH Adherence rate (%)		76	73	64	65	79	94
ED indicators (n=5)		(n=224) %	(n=47) %	(n=35) %	(n=40) %	(n=56) %	(n=46) %
Indicator 2*	hypoxia treated in 30 minutes after onset	100	100	100	100	100	100
Indicator 3*	Supplemental oxygen administered	99.6	97.9	100	100	100	100
Indicator 4	systemic hypotension treated within 30 min of admission**	96.6	100	100	100	100	83.3

Indicator 5	Hypertonic saline or mannitol for high ICP	81.9	100	50.0	83.3	62.1	97.4
Indicator 6	Fever control T < 38.5C	90.6	83	97.1	97.5	87.5	91.3
ED Adherence rate (%)		94	93	95	98	89	96
OR indicators (n10)		(n=122) %	(n=34) %	(n=19) %	(n=16) %	(n=31) %	(n=22) %
Indicator 2*	hypoxia treated in 30 minutes after onset	100	--	--	100	100	100
Indicator 3*	Supplemental oxygen administered	100	100	100	100	100	100
Indicator 4*	systemic hypotension treated within 30 minutes of admission**	98.3	93.8	100	100	100	100
Indicator 5	Hypertonic saline or mannitol for high ICP	78.2	70	50	100	63.2	100
Indicator 6	Fever control T < 38.5C	99.2	100	100	100	96.8	100
Indicator 7	All CPP > 40mmHg	90.2	91.2	89.5	87.5	83.9	100
Indicator 9	Neuromuscular blockade monitored	18.8	31	5.3	0	32.1	9.1
Indicator 11*	External ventricular drain used for high ICP	54.5	50	75	75	15.8	88.9
Indicator 12	Barbiturates used in high ICP	1.8	0	0	0	0	5.6

Indicator 16	Decompressive Craniectomy used in high ICP <i>or/and</i> EDH/SDH	62	46.7	62.5	100	36.7	100
OR Adherence rate (%)		72	74	70	75	64	78
ICU indicators (n=14)		(n=236) %	(n=50) %	(n=42) %	(n=40) %	(n=56) %	(n=48) %
Indicator 2*	hypoxia treated in 30 minutes after onset	100	100	100	100	100	100
		Total (n=236) %	Center 1 (n=50) %	Center 2 (n=42) %	Center 3 (n=40) %	Center 4 (n=56) %	Center 5 (n=48) %
Indicator 3*	Supplemental oxygen administered	99.6	100	100	97.5	100	100
Indicator 4*	systemic hypotension treated within 30 minutes of admission**	98	91.3	100	100	100	100
Indicator 5	Hypertonic saline or mannitol for high ICP	98.6	83.7	79	81.3	92.3	100
Indicator 6	Fever control T < 38.5C	53.8	76	66.7	75	37.5	20.8
Indicator 7	All CPP > 40mmHg	83.9	90	83.3	82.5	69.6	95.8
Indicator 8	ICP monitoring within 4 hours of admission	64.4	80	23.8	52.5	69.6	87.5
Indicator 9	Neuromuscular blockade monitored	3	4	4.8	0	0	2.6

Indicator 10	Normocarbica (PaCO ₂ 30-40mmHg) in absence of herniation	45.5	52.4	0	36.8	12.5	100
Indicator 11	External ventricular drain used for high ICP	79.3	97.7	52.6	84.4	23.1	79.1
Indicator 12	Barbiturates used in high ICP	9.1	16.3	10.5	9.4	2.6	7
Indicator 13	Antiepileptic medication to prevent early seizures	76.7	100	92.9	67.5	30.4	100
Indicator 14	Steroids not used	90.3	84	81	90	100	93.8
Indicator 15	Nutrition started ≤ 72 hours after admission	76.7	82	61.9	75	91.1	68.8
ICU Adherence rate (%)		68	74	64	69	64	72

**=systemic hypotension ($70 + 2$ [age]; years).

Supplemental Digital Content - Table 6: Association of Adherence to 2003 Pediatric Guidelines and Specific Indicators with Outcomes; all Treatment Locations Combined.

	In-hospital mortality <i>aHR(95% CI)</i>	Vegetative/ Major Impairment(ref=Baseline/Minor/Mod Impairment) <i>aRR (95% CI)</i>
<i>Indicators</i>		
<i>PH Hypoxia treated within 30 minutes after onset</i>		
Hypoxia present and untreated or treated >30 minutes	1.00(Ref)	
Hypoxia present and treated with O ₂ ≤ 30 minutes	0.27 (0.01, 5.11)	
No hypoxia present	0.20 (0.08, 0.46)	
<i>OR maintenance of CPP > 40mmHg</i>		
Any CPP ≤ 40mmHg		1.00 (Ref)
All CPP > 40 mmHg		0.61 (0.58, 0.64)
No Surgery of any type		0.68 (0.53, 0.86)
<i>OR neuromuscular blockade monitoring</i>		
NMB not monitored		1.00 (Ref)
NMB monitored		1.13 (0.85,1.51)
No NMB given		1.37 (1.24,1.53)
<i>ICU maintenance of CPP > 40mmHg</i>		
Any CPP ≤ 40mmHg		1.00 (Ref)
All CPP > 40 mmHg		0.73 (0.63,0.84)
<i>OR Decompressive Craniectomy</i>		
No= No DC for high ICP or/and EDH or/and SDH or/and cerebral edema	1.00 (Ref)	

Yes= DC for high ICP <i>or/and</i> EDH <i>or/and</i> SDH <i>or/and</i> cerebral edema	1.65 (0.38, 7.29)	
No surgery, high ICP <i>or/and</i> EDH <i>or/and</i> SDH <i>or/and</i> cerebral edema †	5.33 (3.44, 8.24)	
No surgery, no high ICP, no EDH, no SDH, no cerebral edema †	2.52 (0.67, 9.43)	
ICU Early nutrition start		
Start after 72 hours of TBI	1.00 (Ref)	
Start within 72 hours of TBI	0.06 (0.01, 0.26)*	
ICU PaCO₂ > 30mmHg in absence of herniation & PaCO₂ ≤ 30mmHg in presence of herniation (abnormal pupil or CT evidence)		
HERNIATION PRESENT		
PaCO ₂ >30 mmHg	1.00 (Ref)	
PaCO ₂ ≤ 30 mmHg	11.8 (3.7, 37.9)	
NO HERNIATION		
PaCO ₂ ≤ 30 mmHg	1.00 (Ref)	
PaCO ₂ > 30 mmHg	0.22 (0.06,0.81)	

* No difference when mortality model run excluding subjects with abdominal injuries.

** This model excludes those with any surgery and no high ICP or EDH or SDH or cerebral edema because none of the 7 people in this group died.

All models adjusted for age, sex, head abbreviated injury severity (AIS) score, motor Glasgow coma scale score, and maximum non-head AIS. Mortality model not adjusted for ICU LOS whereas GOS model is adjusted for ICU LOS.

--- = indicator not in model.

PH = Pre-hospital, ED = Emergency Department, OR = Operating Room, ICU = Intensive Care unit.