

# Effect of Family Presence on Advanced Trauma Life Support Task Performance During Pediatric Trauma Team Evaluation

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**Importance:** In many hospitals, family members are separated from their children during the early phases of trauma care. Including family members during this phase of trauma care varies by institution and is limited by concerns for adverse effects on clinical care.

**Objective:** The aim of this study is to evaluate the effect of family presence (FP) on advanced trauma life support primary and secondary survey task performance by pediatric trauma teams. We hypothesized that trauma care with FP would be noninferior to care when families were absent.

**Design:** We performed a retrospective video review of consecutive pediatric trauma evaluations. Family presence status was determined by availability of the family.

**Setting:** The study was conducted at an American College of Surgeons–designated level I pediatric trauma center that serves the Washington, DC, metropolitan area.

**Participants:** Participants included patients younger than 16 years of age who met trauma activation criteria and were evaluated by the trauma team in our emergency department.

**Outcome Measures:** We compared task performance between patients with and without FP.

**Results:** Video recordings of 135 trauma evaluations were reviewed. Family was present for 88 (65%) evaluations. Patients with FP were younger (mean age, 6.4 years [SD = 4.1] vs 9.0 years [SD = 4.9];  $P < 0.001$ ) and more likely to have sustained blunt injuries (95% vs 85%,  $P = 0.03$ ). Noninferiority of frequency and timeliness of completion of all primary survey tasks were confirmed for evaluations with FP. Noninferiority of frequencies of secondary survey task completion was confirmed for most tasks except for examination of the neck, pelvis, and upper extremities. Family members did not directly interfere with patient care in any case.

**Conclusions:** Performance of most advanced trauma life support tasks during pediatric trauma evaluation was not worsened by FP. Our data provide additional evidence supporting FP during the acute management of injured children.

**Key Words:** ATLS, trauma, family presence, injury

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Trauma is the leading cause of death and acquired disability in children in the United States, resulting in more than 9 million injuries, 200,000 hospitalizations, and more than 17,000 deaths each year.<sup>1</sup> The initial phase of trauma care requires trauma teams to rapidly identify and treat injuries, prioritizing those that are life

threatening. The advanced trauma life support (ATLS) protocol was developed to standardize the early identification and management of life-threatening injuries and has been shown to improve patient outcomes.<sup>2,3</sup> Although ATLS implementation is effective, the accuracy and efficiency of ATLS task performance during trauma evaluation also impact patient outcomes.<sup>4,5</sup> Errors involving the sequence and timing of ATLS tasks are not uncommon, and when they occur, they can lead to adverse outcomes, even death.<sup>4,5</sup> Recent studies report that errors with a high likelihood for patient harm occur more frequently when ATLS is performed out of order or otherwise not according to ATLS protocol.<sup>6,7</sup>

## Importance

In many hospitals, family members are separated from their children during the early phases of trauma care.<sup>8,9</sup> Providers have concerns that witnessing the initial trauma evaluation may be too traumatic for families or that families may physically or emotionally interfere with patient care.<sup>10,11</sup> Additional reasons for not allowing family to be present include distraction by family during the performance of critical tasks, interference with decision-making and team communication, impedance of trainee teaching, and the potential for litigation.<sup>12–16</sup>

Despite these concerns, family presence (FP) has benefits for both patients and their families during invasive procedures and resuscitations. Patients experience better comfort and pain management as well as reduced anxiety when family members are present.<sup>17,18</sup> Families also report improved communication with medical teams, more accurate sharing of important medical information, and a greater ability to advocate for their child when present.<sup>11</sup>

## Goals of This Investigation

Data on the impact of FP during pediatric trauma team evaluation are limited, and research to date has relied upon retrospective chart review and qualitative studies. To address this issue, we performed this study to evaluate the effect of FP on ATLS primary and secondary task performance using video review to more precisely define task performance. We hypothesized that pediatric trauma evaluation with FP would be noninferior to trauma evaluation without an FP, with a noninferiority margin of 10%.

## METHODS

### Study Design and Setting

This study is based on secondary analysis of data collected through retrospective review of video recordings of consecutive pediatric trauma patients who were treated in one of our trauma bays between May and August 2011. The original data were collected to evaluate trauma team performance. The study was conducted at the Children's National Medical Center in Washington, DC, an urban, level I pediatric trauma center verified by the American College of Surgeons Committee on Trauma, the State

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I, Karen O'Connell, as the principal investigator of this study, 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. All authors of this article report no conflict of interest, including financial interest, activities, relationships, and affiliations.

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of Maryland, and the District of Columbia. Children's National serves as a tertiary care referral center for injured children in the Washington metropolitan area. The study was approved by the Children's National Medical Center institutional review board.

### Trauma Protocol

Trauma team activation at our hospital is based on national triage guidelines that consider the prehospital assessment of suspected injuries, physiologic derangement, and mechanism of injury.<sup>19</sup> "Trauma stat" activations assemble a trauma team composed of a pediatric emergency medicine attending or fellow, surgical fellow or senior surgical resident, junior surgical resident or trauma nurse practitioner, anesthesiologist, respiratory therapist, 4 trauma-trained emergency department (ED) nurses, nurse administrator, social worker, and radiology technician. A higher level activation, a "trauma stat attending," is designated for higher acuity cases and requires the immediate presence of a surgical attending and a critical care medicine fellow in addition to the trauma stat team. The primary and secondary survey assessments are performed by a surgical resident or trauma nurse practitioner who has been trained in ATLS management. Patients who arrive with prearrival notification by emergency medical services are categorized in our study as "activations with notification." Trauma teams usually assemble 10 to 15 minutes before patient arrival for activations with notification. Patients who arrive without notification are categorized as "activations without notification."

### Family Presence

Family presence is defined as the attendance of family members in a location that allows visual or physical contact with their child during resuscitations or invasive procedures.<sup>20</sup> Family presence is encouraged and supported at our institution during all phases of emergency care. In 2006, our ED established a FP policy and procedure that provides education about FP and offers staff guidelines for incorporating family during resuscitations and invasive procedures. A component of our FP guidelines is the designation of a facilitator whose responsibility includes assessing, supporting, and monitoring the family during their child's care. The family facilitator, most often a social worker or child life specialist, has no direct patient care responsibilities.

### Subject Selection

Patients younger than 16 years of age who were treated in one of our trauma bays as a trauma stat or trauma stat attending activation between May and August 2011 were eligible. Patients who were transferred from another institution and already had initial primary and secondary surveys performed were excluded. Family presence was defined as events in which families entered the trauma bay within 30 seconds of the beginning of the first ATLS task and remained in the trauma bay for the duration of the primary and secondary surveys.

### Outcome Measures

The primary outcome of this study was the frequency of completion of ATLS primary survey tasks. The secondary outcomes included (1) frequency of completion of ATLS secondary survey tasks and (2) time to completion of primary survey tasks.

### Data Collection

All trauma team activations at our hospital are recorded using a video recording system. Each trauma bay is equipped with 2 motion-activated, ceiling-mounted wide-angled cameras: 1 directly over the head of the patient's bed and 1 in an oblique-angle view

of the entire trauma bay. Recorded data include time-stamped video from the 2 cameras, audio from microphones, and data from the patient's vital sign monitor. Video recordings of trauma activations were reviewed by 2 members of the research team using a validated data collection tool.<sup>21</sup> Interrater reliability was confirmed with a Pearson correlation coefficient of 0.99 for continuous variables and a kappa statistic no less than 0.89 for binary variables.<sup>21</sup>

Demographic (age, sex), injury-specific (injury mechanism, injury severity score [ISS], simplified motor score [SMS]), and event-specific data (activation level, day vs night shift, weekend vs weekday, prearrival notification, and ED disposition) were abstracted from our institution's trauma registry. The SMS was derived from the motor component of the Glasgow Coma Scale (GCS), with SMS scores of 0, 1, and 2 equal to GCS motor scores of 1 to 4, 5, and 6, respectively. We used the SMS rather than total GCS because the predictive power of the motor score component of the GCS is equivalent to total GCS and is more accurately obtained.<sup>22,23</sup>

### Analysis

Our primary hypothesis was to prove noninferiority of trauma team evaluation with FP compared with evaluation without FP. One-sided tests with noninferiority margins of 1 minute were used for the analysis of time to primary and secondary

**TABLE 1.** Patient Demographics and Injury Characteristics by FP, N = 135

	Family Present, N = 88	Family Not Present, N = 47	P
Age, y	6.5 (4.1)	9.0 (4.9)	0.002
Female	31 (35.2)	14 (29.8)	0.52
Attending activation	4 (4.6)	6 (12.8)	0.10*
Activation without notification	34 (26.6)	3 (9.4)	0.06
Penetrating injury	3 (3.4)	7 (14.9)	0.03*
SMS			
2	78 (88.6)	38 (80.9)	0.43
1	6 (6.8)	5 (10.6)	
0	4 (4.6)	4 (8.5)	
ISS			
<9	64 (72.7)	33 (70.2)	0.77*
9–15	12 (13.6)	6 (12.8)	
16–25	7 (8.0)	3 (6.4)	
>25	5 (5.7)	5 (10.6)	
Shift			
7:00 AM–7:00 PM	57 (64.8)	32 (68.1)	0.70
7:00 PM–7:00 AM	31 (35.3)	15 (31.9)	
Weekday	63 (71.6)	31 (66.0)	0.50
Disposition from ED			
Discharge home	40 (45.5)	15 (31.9)	0.13*
Observation unit	11 (12.5)	2 (4.3)	
Pediatric intensive care unit	15 (17.1)	12 (25.5)	
Operating room	3 (3.4)	4 (8.5)	
Inpatient unit	19 (21.6)	14 (29.8)	

Results are reported as mean (SD) for continuous variables and n (%) for categorical variables.

\*Fisher exact test.

survey task completion. A noninferiority margin of 0.1 difference (10%) in proportions of task completion was used as a clinically meaningful difference. Rejection of the null hypothesis indicates that the frequency of task completion with family members present is inferior to the frequency of task completion without families present.

We also constructed multivariate models to determine the effect of FP on ATLS primary survey performance. Generalized linear models were used to determine the effect of FP on frequency and time to completion of 7 primary survey tasks controlling for confounders and accounting for multiple variables within each event. These models had 135 clusters corresponding to the 135 events, with a maximum cluster size of 7, and were adjusted for age, injury type (blunt vs penetrating), and SMS.

Data analyses were performed using SAS v.9.2 (SAS Institute Inc, Cary, NC).

## RESULTS

### Characteristics of Study Subjects

Two hundred twenty-two videos were available for review during the study period. Seventy-seven patients were transferred from another institution and were excluded. Ten patients had family members arrive partway through the ATLS primary and secondary surveys and were also excluded, for a final sample of 135 pediatric trauma evaluations. Family members were present during 88 (65%) of 135 events. Patients who were treated with and without FP did not differ with respect to sex, activation level, injury severity, time of day, day of week, or ED disposition (Table 1). Children treated with family present, however, were younger (mean age, 6.5 years [SD = 4.1] vs 9.0 years [SD = 4.9];  $P = 0.002$ ) and more likely to have sustained blunt

injuries (97% vs 85%,  $P = 0.03$ ). Six patients required intubation in the trauma bay (3 with family present and 3 without), and 1 tube thoracostomy was performed in a patient with no family present. No study patients died in the trauma bay.

### Main Results

Comparison of the frequencies of completion of ATLS primary survey tasks by noninferiority testing showed task completion for all aspects of the primary survey to be noninferior when family members were present (Table 2). For example, the airway was examined in 93.2% and 93.6% of cases with and without family present, respectively, with the difference in frequencies less than the predetermined clinical margin of 10%. For the secondary survey, noninferiority was established for frequencies of completion for examinations involving the head, ears, eyes, cervical spine, chest, abdomen, lower extremities, and spine for trauma evaluations with FP. We could not conclude that frequencies of completion for the examinations involving the neck (soft tissue), pelvis, and upper extremities were not inferior with FP (Table 2).

For mean times to completion of ATLS primary survey tasks, noninferiority was confirmed for all tasks except the time until temperature measurement (Table 3). For example, time to GCS assessment was noninferior for trauma evaluations with FP (2 minutes 23 seconds when family was present compared with 2 minutes 11 seconds when family was not present). Even though the mean time to temperature measurement was shorter with FP, the results of the noninferiority test were inconclusive (6.35 minutes [SD = 4.28] vs 6.56 minutes [SD = 4.64] with and without FP, respectively;  $P = 0.07$ ). After adjusting for the potential confounders of age, injury type (blunt vs penetrating), and SMS, FP did not affect the frequency of or the time to

**TABLE 2.** Frequency of Primary and Secondary Survey Tasks by FP, N = 135

	Family Present	Family Not Present	Test of Independence <i>P</i>	Noninferiority <i>P</i> *
<b>Primary Survey</b>				
Airway	93.2%	93.6%	0.92 <sup>†</sup>	0.02
Breath sounds	100%	100%	—	—
Heart rate	33.0%	23.4%	0.25	0.007
Pulse	93.2%	89.4%	0.51 <sup>†</sup>	0.004
GCS	92.1%	93.6%	0.99 <sup>†</sup>	0.03
Pupils	95.5%	95.7%	0.99 <sup>†</sup>	0.004
Temperature	95.5%	89.4%	0.28 <sup>†</sup>	<0.001
<b>Secondary Survey</b>				
Head	85.2%	83.0%	0.73	0.03
Ears	93.2%	89.4%	0.51 <sup>†</sup>	0.004
Eyes	26.1%	19.2%	0.36	0.01
Neck	37.5%	44.7%	0.42	0.38 <sup>‡</sup>
Cervical spine	68.2%	59.6%	0.32	0.02
Chest	85.2%	78.7%	0.34	0.01
Abdomen	97.7%	97.9%	0.99 <sup>†</sup>	<0.001
Pelvis	76.6%	85.1%	0.43	0.26 <sup>‡</sup>
Upper extremities	61.4%	70.2%	0.31	0.45 <sup>‡</sup>
Lower extremities	93.2%	93.6%	0.99 <sup>†</sup>	0.02
Spine	100%	95.7%	0.12 <sup>†</sup>	<0.001

\*Noninferiority test with  $\delta = 0.1$ .

<sup>†</sup>Fisher exact test.

<sup>‡</sup>Cannot conclude that FP frequency is not inferior.

**TABLE 3.** Time to ATLS Primary Survey Tasks, N = 135

Primary Survey Tasks	Family Present	Family Not Present	Student <i>t</i> test <i>P</i>	Noninferiority <i>P</i> *
	Mean (SD)	Mean (SD)		
Airway	1.22 (0.87)	1.15 (0.96)	0.67	<0.001
Breath sounds	1.24 (0.76)	1.24 (0.91)	0.98	<0.001
Heart rate	2.34 (1.60)	3.72 (4.72)	0.36	0.01
Pulse	2.03 (1.91)	1.79 (1.35)	0.42	0.006
GCS	2.38 (0.97)	2.18 (1.43)	0.31	<0.001
Pupils	2.65 (1.86)	2.92 (2.35)	0.48	<0.001
Temperature	6.35 (4.28)	6.56 (4.64)	0.80	0.07†

Results are reported in minutes.

\*Noninferiority test with  $\delta = 1$  (1 min).

†Cannot conclude that FP mean is not inferior.

ATLS primary survey task completion. Video review and a review of incident reports found no cases in which family members' physical or emotional responses necessitated their removal from the trauma bay.

## DISCUSSION

Observed ATLS primary and secondary survey task performance during pediatric trauma team evaluations was not inferior when family members were present for most tasks performed by the trauma team. Regardless of FP, most patients in our study had all primary survey tasks completed within 5 minutes, a commonly used threshold goal for completing the primary survey.<sup>24</sup> We could not conclude noninferiority for 3 tasks of the secondary survey: examination of the neck, pelvis, and upper extremities. The point estimates for the differences in frequency of these 3 tasks, however, were small and not greater than 10%, but the relatively low frequency of completion in both groups made testing for noninferiority inconclusive. In addition, the results of noninferiority testing for mean time to temperature measurement were inconclusive because of the large variance of the time to temperature, despite a shorter measured time to this task in the FP group.

Our results support previous findings that report no clinically significant differences in patient care when family members witness the initial phases of their child's trauma care. One study involving 196 pediatric trauma resuscitations reported no significant difference in the times to completion of the primary and secondary surveys and no cases in which family members interfered with care.<sup>8</sup> A similar study involving 283 pediatric trauma patients showed no difference in times to computerized tomography scan and completion of resuscitations when family members were present and no cases in which family members were asked to leave the resuscitation area.<sup>9</sup> In a recent study involving adult patients receiving cardiopulmonary resuscitation in a prehospital setting, FP had no adverse impact on resuscitation performance, patient survival, or degree of provider stress, and less than 1% of family members displayed behaviors that were concerning.<sup>25</sup>

This study is unique in the use of video review to evaluate the impact of FP on ATLS task performance during pediatric trauma evaluation. Video review is an effective and reliable way to collect trauma data and is more accurate than medical record review in evaluating ATLS task performance.<sup>26,27</sup> One previous study has addressed the family interactions during adult trauma resuscitations using video review at 3 level I trauma centers and reported no cases of direct family member interference among 88 cases in which family members were present. In contrast to our study,

most previous studies have been limited to retrospective data collection from scribed trauma records, with data accuracy and completeness reliant upon event documentation.

Over the past decade, family-centered care has become a quality focus for US hospitals, and best practice recommendations have been disseminated through national consensus conferences and joint policy statements.<sup>28,29</sup> The emotional benefits of FP for both families and patients are supported in the literature.<sup>20</sup> Actual family member experiences, surveys, and postevent interviews support the positive experiences and perceptions of being present. Being with their child during invasive procedures and resuscitation decreases patient and parental anxiety and fear, and gives parents comfort in knowing that everything possible was done for their children.<sup>10,17</sup> When families are present, they can better advocate for their children in real time and reinforce their role as a valued member of the medical care team.<sup>30</sup> Even when resuscitation efforts were unsuccessful, parents who were with their child at the time of death experienced a greater sense of closure.<sup>10,11</sup>

## Limitations

Our study has several limitations. First, the study was conducted at a single level I pediatric trauma center located in a populated, urban setting, which limits the generalizability of our study findings. Most injured children in the United States are evaluated and cared for in nonpediatric trauma centers and community hospitals.<sup>31</sup> The generalizability of our study results may also be limited to hospitals with established FP policies similar to ours that include psychosocial support for the family and provider education designed to promote the successful practice of FP.

A second study limitation is that we chose to study 1 aspect of trauma resuscitation. Our outcome measures were focused on primary and secondary ATLS survey task timeliness and completeness. We did not measure times to invasive procedures (eg, intubation or chest tube thoracostomy) or other aspects of team performance that may require higher order decision-making. We are aware that therapeutic interventions beyond the ATLS primary and secondary survey impact patient outcome such as intubation, correction of hypotension, and control of hemorrhage.<sup>32</sup> This study was underpowered to determine the influence of FP on the completion or success of these therapeutic interventions, as well as on patient survival, because no deaths were observed in this cohort. In addition, despite the consecutive enrollment of patients during a "high trauma volume" period of time, only a small percentage of our enrolled trauma patients was severely injured (15.7% with ISS of >15) and few had highly invasive procedures

or needed to go immediately to the operating room. Evaluation of FP for patients requiring highly invasive procedures, such as resuscitative thoracotomy, was beyond the scope of this project given our patient characteristics. Lastly, our study did not measure patient-centered outcomes or family reports of the experiences, both of which need to be further addressed in future studies.

## CONCLUSIONS

In summary, our study results support the hypothesis that for most ATLS primary and secondary tasks, completion and timeliness were noninferior when family members were present during pediatric trauma team evaluations. Our data provide additional evidence supporting the inclusion of FP during the acute management of most injured children.

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