Human Factors In Prehospital Pediatric Emergencies

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Background

- Pediatric emergencies represent a high risk, low frequency event in EMS
- EMS providers have difficulty managing pediatric illness[1] and errors are common[2]
- There is limited information on EMS team dynamics, human factors, and non-technical skills as a root cause of errors during pediatric encounters[3]

Objective

To quantify human factors associated with medical errors in the prehospital management of pediatric emergencies

Methods

- **Study setting:** Mobile simulation laboratory conducting 2 scenarios
  - Pediatric Seizure
  - Infant hypoglycemia
- **Study population:** EMS providers from one urban fire agency
- **Study design:** Exploratory study utilizing task analysis of EMS providers participating in pediatric high-fidelity simulations
- **Methods:** Single investigator quantified outcomes via video review:
  - Time to task completion ***(minutes:seconds)***
  - Process Mapping ***(swimlane diagram)***
  - Human factors assessment ***(Anesthetists Non-Technical Skills [ANTS] instrument[4] 1-5 scale, <3= safety risks)***

Figure 1: Scenario One Timeline

18 month old with fever, tachycardia, seizure from sepsis

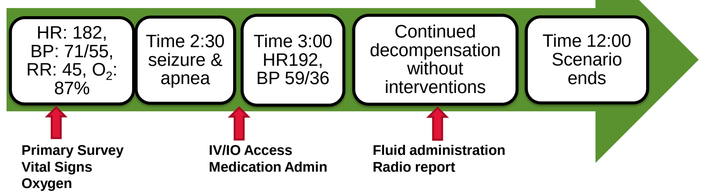


Figure 2: Scenario Two Timeline

1 month old with sepsis and hypoglycemia

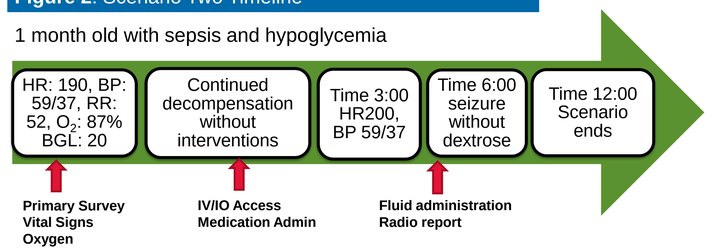
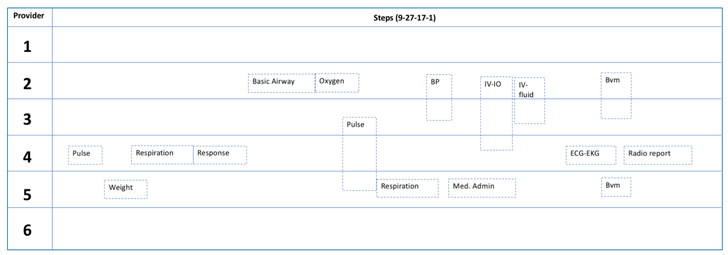
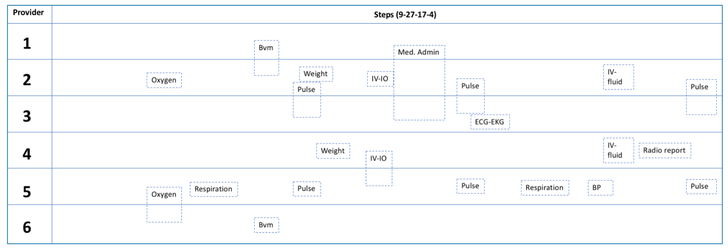


Figure 3: Swimlane Diagrams Depicting Observed Tasks
Each lane represents a provider and the task they complete, timeline of intervention is from left to right.





Results:

Table 1: Task Analysis (24 unique simulations with 112 EMS providers)

Task (n)	Median number of providers involved (IQR)	Median task time (mm:ss)	Median time to completion from scenario start (mm:ss)
Responsiveness check (11)	1 (1,2)	00:04	01:52
Breathing check (24)	1 (1, 1)	00:22	00:54
Pulse check (23)	1 (1,1)	00:19	00:34
Blood pressure (22)	1 (1,2)	00:40	01:33
Oxygen delivery (24)	1 (1,2)	01:00	01:52
IV/IO access (24)	2 (1,3)	02:43	05:03
IV Fluid (22)	1 (1,2)	03:37	08:27
Medication Administration (24)	2 (1, 2.25)	02:21	05:26

Table 2: Time Intervals

Intervals	n	Median task time (mm:ss)	Median time from scenario start (mm:ss)
Time to midazolam (seizure start to midazolam administration)	12	02:43	04:55
Time to dextrose (low BGL to dextrose administration)	12	02:37	5:43

Table 3: ANTS Score and Subcategories

Category	Score
Overall	2.2
Task Management	2.2
Team Work	2.2
Situational Awareness	1.9
Decision Making	2.4

ANTS Scale: 1=significant lapses in safety or error, 2=some lapses which could effect patient safety, 3=adequate performance, 4=patient safety consistently maintained, 5=performed at highest level

Discussion

- **Task Analysis**
  - Significant delays in oxygen administration
  - Significant delays in obtaining IV/IO access and administering fluids
  - Longer intervals reflect poor team dynamics
- **Human Factors**
  - Risks to patient safety identified in all subcategories (***ANTS<3***)
  - Rare use of closed loop communication, clarification of team roles
  - Tasks repeated often due to poor communication
  - Team dynamics contributed significantly to errors observed

Conclusions

- In pediatric simulation, human factor challenges are associated with:
  - *Delays in key interventions*
  - *Protocol adherence*
- Interventions such as ***defining responsibilities***, ***utilizing checklists*** and ***effective communication*** may reduce errors during pediatric EMS encounters

References

[1]Barata, I. A., Benjamin, L. S., Mace, S. E., Herman, M. I., & Goldman, R. D. (2007). Pediatric Patient Safety in the Prehospital/Emergency Department Setting. Pediatric Emergency Care, 23(6), 412-418
[2]Meckler, G., Hansen, M., Lambert, W., Obrien, K., Dickinson, C., Dickinson, K., Guise, J. (2017). Out-of-Hospital Pediatric Patient Safety Events: Results of the CSI Chart Review. Prehospital Emergency Care, 22(3), 290-299
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[4]Myers, J. A., Powell, D. M., Psirides, A., Hathaway, K., Aldington, S., & Haney, M. F. (2016). Non-technical skills evaluation in the critical care air ambulance environment: Introduction of an adapted rating instrument - an observational study. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 24(1)