

# Accuracy of Pediatric Prehospital Medication Dosing Using a Calculation-Free Tool: A Mixed Methods Study

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## BACKGROUND

- Pediatric prehospital medication dosing errors are a common problem, occurring in 30-60% of cases
- Medication dosing tools exist to assist with weight based dosing in the field
  - A length based tape (Broselow tape) is the most commonly used tool
  - Calculation free tools (Handtevy system) have been created as an alternative

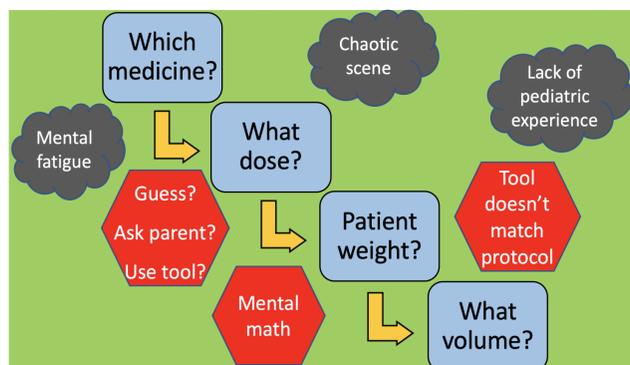


Figure 1: Challenges facing paramedics during pediatric runs

Dosing Tools	Length Based Tool	Calculation Free Tool
Length based	✓	
Age based		✓
Dosing in mg	✓	
Dosing in mL		✓
Customized to formulary		✓
Standardized color scheme	✓	✓
Multiple formats		✓
Formal training		✓

Figure 2: Comparisons of length based and calculation free tool

## OBJECTIVES

- Primary: to compare dosing accuracy of a calculation-free tool relative to a length based tool
- Secondary: to evaluate preferences of paramedics regarding the use of the two different dosing tools

## MEDICATION DOSING ACCURACY (QUANTITATIVE)

### METHODS

**EMS agency:** Houston Fire Department (HFD)  
**Inclusion Criteria:** Patients 0-13 years old who were transported by HFD to any of 12 local hospitals  
**Exclusion Criteria**

- Received inhaled medications only
- Had medications administered by a BLS crew
- Had no medication dose documented
- Had no ED weight recorded

**Outcomes Measures:** accuracy of medication dosing (defined as +/- 20% of the recommended protocol dose)

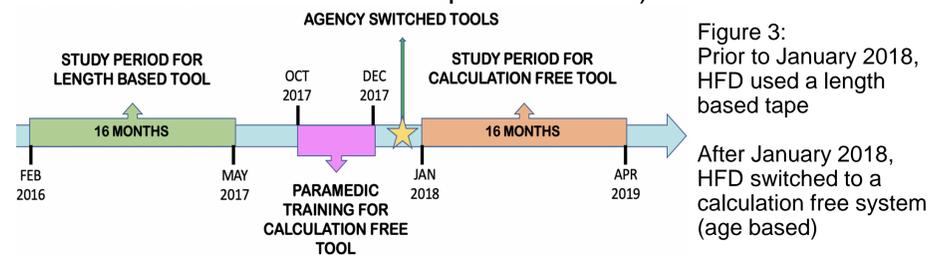


Figure 3: Prior to January 2018, HFD used a length based tape. After January 2018, HFD switched to a calculation free system (age based)

### RESULTS

- 769 medication administrations
- Overall medication dosing accuracy: 69.8% (95% CI: 66.5-73.1%)
- Length based tool accuracy: 69.5% (N = 365)
- Calculation free tool accuracy: 70.0% (N = 404)
- Odds Ratio 1.02 (95% CI: 0.74-1.41; p=0.89)

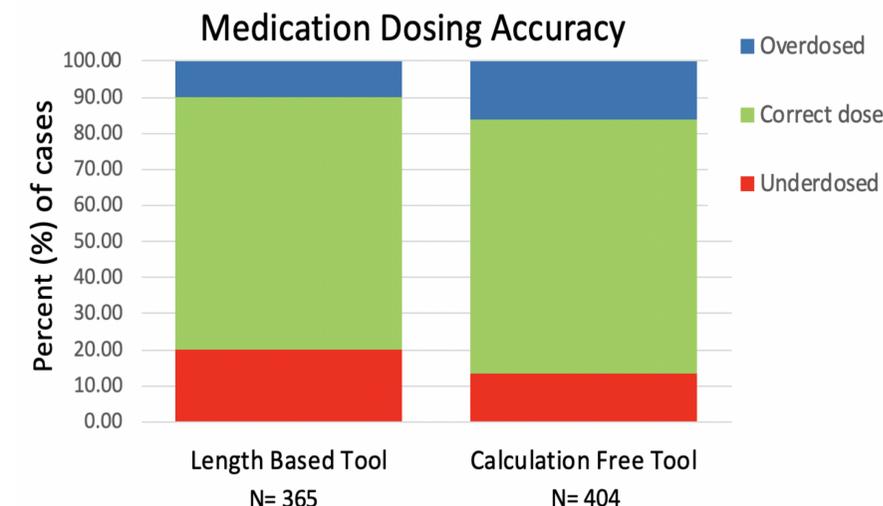


Figure 4: % of cases that were underdosed (red), overdosed (blue), and correctly dosed (green)

## PARAMEDIC INTERVIEWS REGARDING DOSING TOOLS (QUALITATIVE)

Phone interviews were conducted with paramedics regarding both dosing tools until thematic saturation was reached. Then, member checking was performed to validate results. Responses were analyzed for codes and themes.

### Ease of use

Attributes: simple layout; volume based dosing, color coding  
 Quote: "The calculation free tool was very simple to use and very straight forward. It takes the decision making and mental math out. Just being able to go straight to the dose is more beneficial."

### Speed of use

Attributes: decreased cognitive load; dose determined prior to scene arrival  
 Quote: "You can get the medications on board quicker without having to fool around with medication dosages and doing the math on scene."

### Utility

Code: tailored to EMS agency protocols; only relevant information  
 Quote: "The length based tool has standard medication dosages versus the calculation free tool, which has the agency specific dosages approved for our protocols."

### Reduction of error

Code: mental fatigue; less reliance on bystander information  
 Quote: "The calculation free tool is taking the guesswork out at 3 or 4 AM when you are not as sharp on your dosage calculations."

Figure 5: 4 themes were identified through paramedic surveys. Codes and sample quotes are shown

## CONCLUSIONS

- Prehospital pediatric medication dosing errors continue to be a common occurrence despite new dosing tools
- The calculation free tool did not significantly improve dosing accuracy
- Paramedics prefer dosing tools that are:
  - Calculation free
  - Provide doses in volumes
  - Come in multiple formats
  - Formulary specific