



# Pediatric Weight Errors and Resultant Medication Errors in the ED

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## Background

Obtaining and recording the patient's weight is done routinely in the emergency department (ED) and is the first step in medication dosing calculations. However, weight errors can lead to medication calculation errors, which can potentially harm the patient.

## Methods

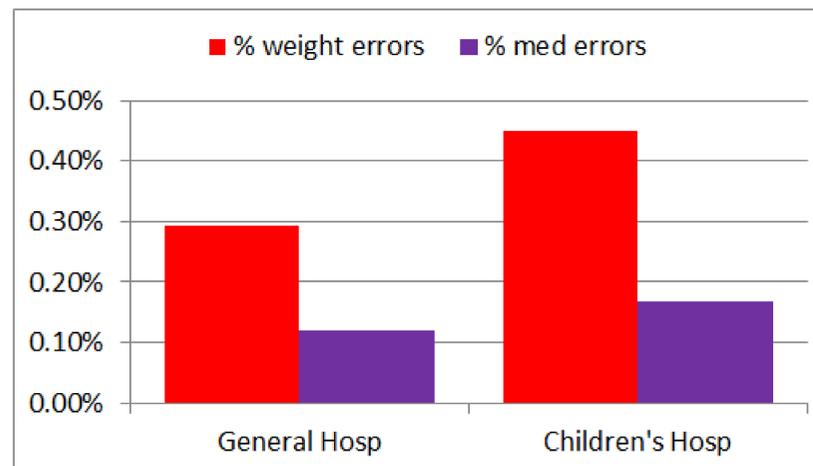
We obtained a serial listing of ED patient encounters for children 5 years of age and below at a children's hospital and two general hospitals in the same hospital electronic medical record system (EMR). We then determined the 3rd percentile and the 97th percentile weight for the patient's decimal age using Centers For Disease Control (CDC) growth percentiles. We then flagged all patient encounters with weights that were less than the 3rd or greater than the 97th percentile weights to identify outliers that could potentially represent weight errors. We then reviewed the EMR chart for all such outliers to determine if a true weight error was present and if a medication error occurred because of this. Following the identification of the weight and medication errors, we can calculate error rates in the children's hospital ED and two general hospital EDs to determine if the error rates were approximately the same or not. Roughly half the data set for the children's hospital (January 1, 2009 to October 31, 2012) has been analyzed and the entire data set for one of the general hospitals (January 1, 2009 to August 31, 2013) has been analyzed. These results are summarized here.

Weight 22 pounds  
kg

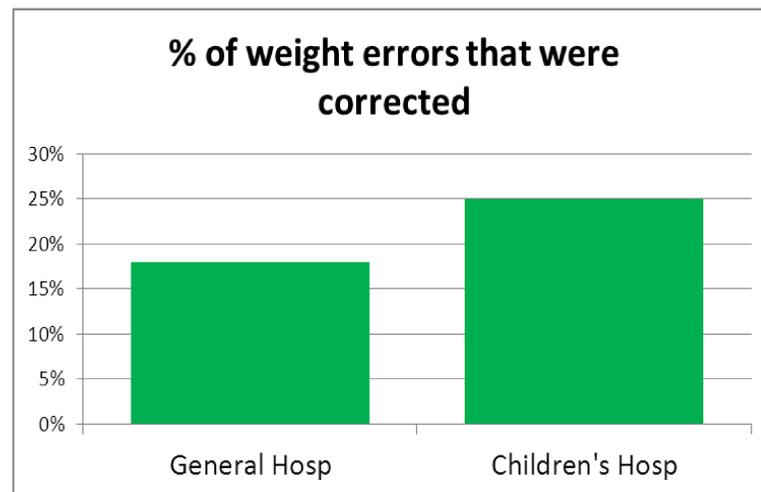
Weight 98.6 kg

## Results

**Percentage of weight and med errors at General vs Children's hospitals (errors / all encounter <=5yrs)**



- At the General Hospital, 0.29% of the weights were errors resulting in 0.12% of the encounters that had medication errors.  
 - At the Children's Hospital, 0.45% of the weights were errors resulting in 0.17% of the encounters that had medication errors.



- At the General Hospital, 18% of the weight errors that were found were corrected by the ED staff (they noticed the error and corrected it).  
 - At the Children's Hospital, 25% of the weight errors were corrected by the ED staff (they noticed the error and corrected it).

**Table: General Hospital data vs. Children's Hospital**

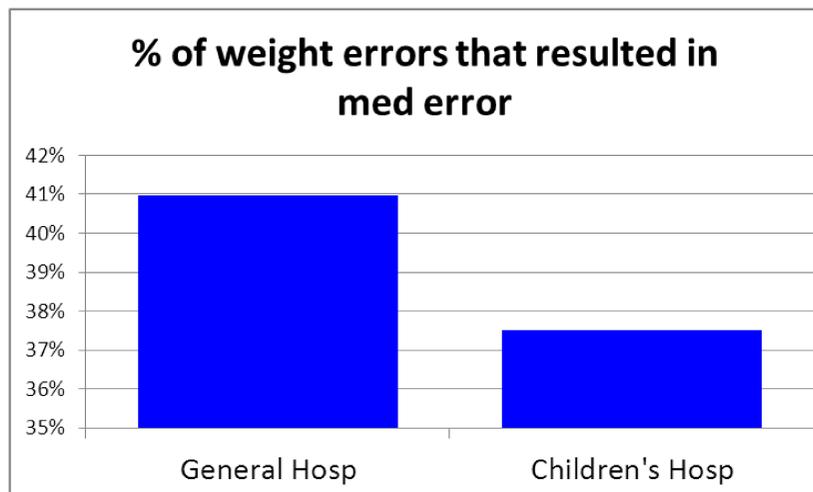
	General Hospital	Children's Hospital
Total encounters	20,790	16,011
Weight errors	61	72
Med Errors	25	27
Corrected weights	11	18
Cannot be determined	9	121

### Extreme weight errors:

- General hospital had 5 extreme weight errors (0.024%): **702 kg, 182 kg, 161 kg, 121 kg, 96.2 kg**  
 - Children's hospital had 10 extreme weight errors (0.019%): **4365 kg, 1601 kg, 808 kg, 162 kg, 137 kg, 99.6 kg, 98.4 kg, 97.6 kg, 97.6 kg, 70.3 kg** (full cohort rather than half)

### Common medications in weight based dosing errors:

- Tylenol
- Ibuprofen
- Ondansetron
- Corticosteroids
- IV fluid infusion volumes
- Antibiotics (e.g., amoxicillin, ceftriaxone)



- At the General Hospital, 41% of weight errors resulted in a medication error.  
 - At the Children's Hospital, 38% of weight errors resulted in a medication error.

## Discussion

In this retrospective chart review, approximately 0.17% of patient encounters less than 5 years old were subjected to medication errors in the children's ED. In another study by Kozer et al, the incidence of medication errors in the pediatric ED is 10.1%. Some of the common medications that were given in weight based medication dosing errors were tylenol, ibuprofen, and antibiotics. There were other medications that were dosed in error that have the potential to result in more serious complications, such as pentobarbital.

Weight errors leading to medication errors in the ED are complex due to the nature of the ED. It is often fast paced and medications need to be prescribed urgently without necessarily knowing the history of the patient. According to Leape et al, the most common defects were in the systems in place to disseminate knowledge about drugs and patient information. Prevention of these errors could be aimed at improving medication systems. These include having a pharmacist available to dispense the medication and to monitor any prescribing errors once the medications are ordered, (Leape et al), using a preprinted medication order form (Kozer et al), using the Breslow Tape for children that are less than 25kg (Lubitz et al), and having fixed dose weight-based order sets (Doherty et al).

The present study has several limitations. We did not identify the most high risk medications that were administered. Our study was limited to three medical centers, which may affect the comparison of our results to other care settings.

## Conclusions

Weight errors in this study occurred at a low rate. However, some of these have the potential to cause patient underdosing and overdosing medication errors. These can lead to serious harm, such as prolonged hospitalization, unnecessary tests, irrelevant treatments and even death. Further research needs to be done in the future in regards to effective systems that will reduce medication errors in the pediatric ED.

## References

- Kozer Eran, et al. Large Errors in the Dosing of Medications for Children. N Engl J Med. 2002; 346:1175-1176  
 Leape Lucian, et al. Systems Analysis of Adverse Drug Events. JAMA. 1995;274(1):35-43  
 Doherty C, et al. Tenfold medication errors: 5 years' experience at a university-affiliated pediatric hospital. Pediatrics. 2012 May;129(5):916-24.  
 Lubitz DS, et al. A rapid method for estimating weight and resuscitation drug dosages from length in the pediatric age group. Ann Emerg Med. 1988 Jun;17(6):576-81.