

Prevalence of Pediatric Medication Protocol Deviation by EMS Clinicians

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BACKGROUND

In the United States, emergency medical services (EMS) treatments are guided by clinical protocols. Up to 43% of pediatric medication administrations in the prehospital setting have been found to deviate from recommended dosages (DRD). Though certain medications are associated with higher rates of DRD, there is a need to better understand the systematic drivers of this problem.

OBJECTIVE

We sought to determine the prevalence of DRD based on medication, clinician impression, route of administration, and patient age. We also sought to determine whether an association exists between degree of DRD and error in weight estimation.

METHODS

DESIGN: We performed a secondary analysis of a regional quality improvement registry of pediatric (age ≤ 15 years) weight estimation by EMS clinicians.

OUTCOME: The primary outcome was the prevalence of DRD, defined as doses deviating more than 20% from clinical protocols. The secondary outcome was the association between degree of DRD and error in weight estimation.

PROCEDURE: We excluded oxygen, saline, inhaled medications, epinephrine infusion, oral glucose, and intravenous dextrose and calculated weight-based dosages using hospital weights. Missing routes were inferred when a protocol indicated a single route for a medication. For medications with multiple routes, the cases were manually reviewed. To detect a DRD, we used a layered approach of checking weight-based thresholds first followed by absolute limits.

ANALYSIS: We used the Kruskal Wallis test for the primary outcome and a linear regression for our secondary outcome. We performed a sensitivity analysis that excluded potential fixed dosage formulations (e.g., 4mg ondansetron) or full-vial dosages (e.g., 125mg methylprednisolone) to explore whether this could be contributory to DRDs.

RESULTS

We analyzed 386 medication administrations for 240 patients. The overall prevalence of DRD was 46.4% (n=179), of which 79.9% (n=143) were underdoses. Failing to achieve the weight-based threshold was the most common reason for a DRD (n=287, 74.4%).

Figure 1: Degree of DRD by medication

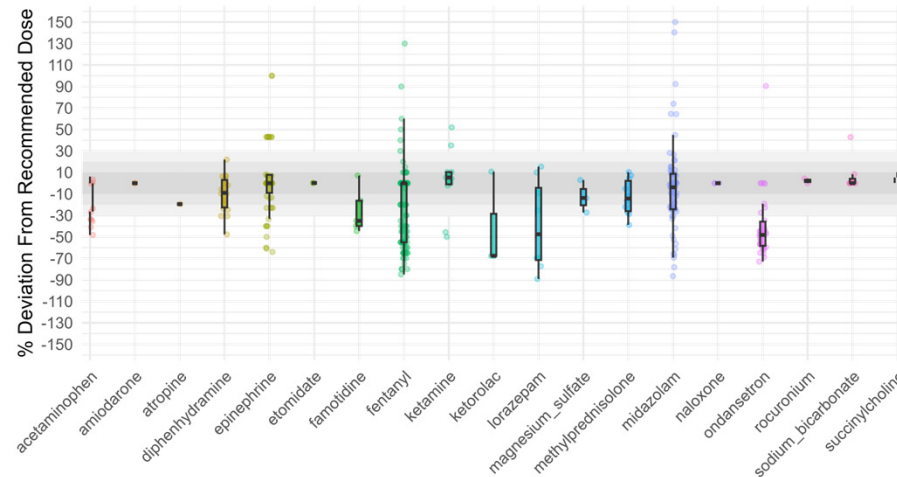
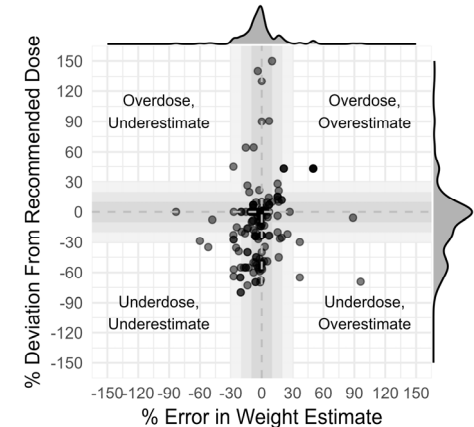
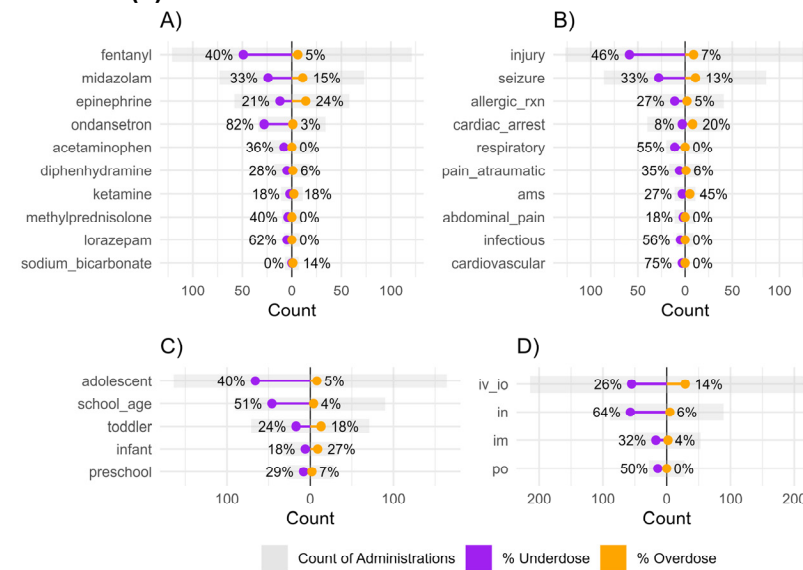


Figure 2: Error in weight estimate vs DRD



Error in weight estimation was not associated with DRD ($\beta = 0.13$, $r^2 = .26$, $p = .349$).

Figure 3: Prevalence of DRD by medication (A), impression (B), age (C), and route (D).



Only the 10 most common medications and impressions are depicted.

Sensitivity Analysis: The prevalence of DRD was significantly higher among pooled potential oral fixed dose formulations and potential full vial administrations (31/38, 81.6% vs. 148/348, 42.5%; $p < .001$).

LIMITATIONS

Retrospective study is limited by documentation quality. Each medication administration was treated independently to maximize sample size, but we did not account for clustering by clinician. The clinical implications of our results are not known.

CONCLUSION

Medications administered by EMS clinicians to pediatric patients deviated from recommended dosing in nearly half of all cases.

Error in weight estimation was not associated with DRD. The use of fixed dosage formulations or full-vial dosages may contribute to DRD, suggesting that many DRDs are not due to error in dose calculation or weight estimation.

